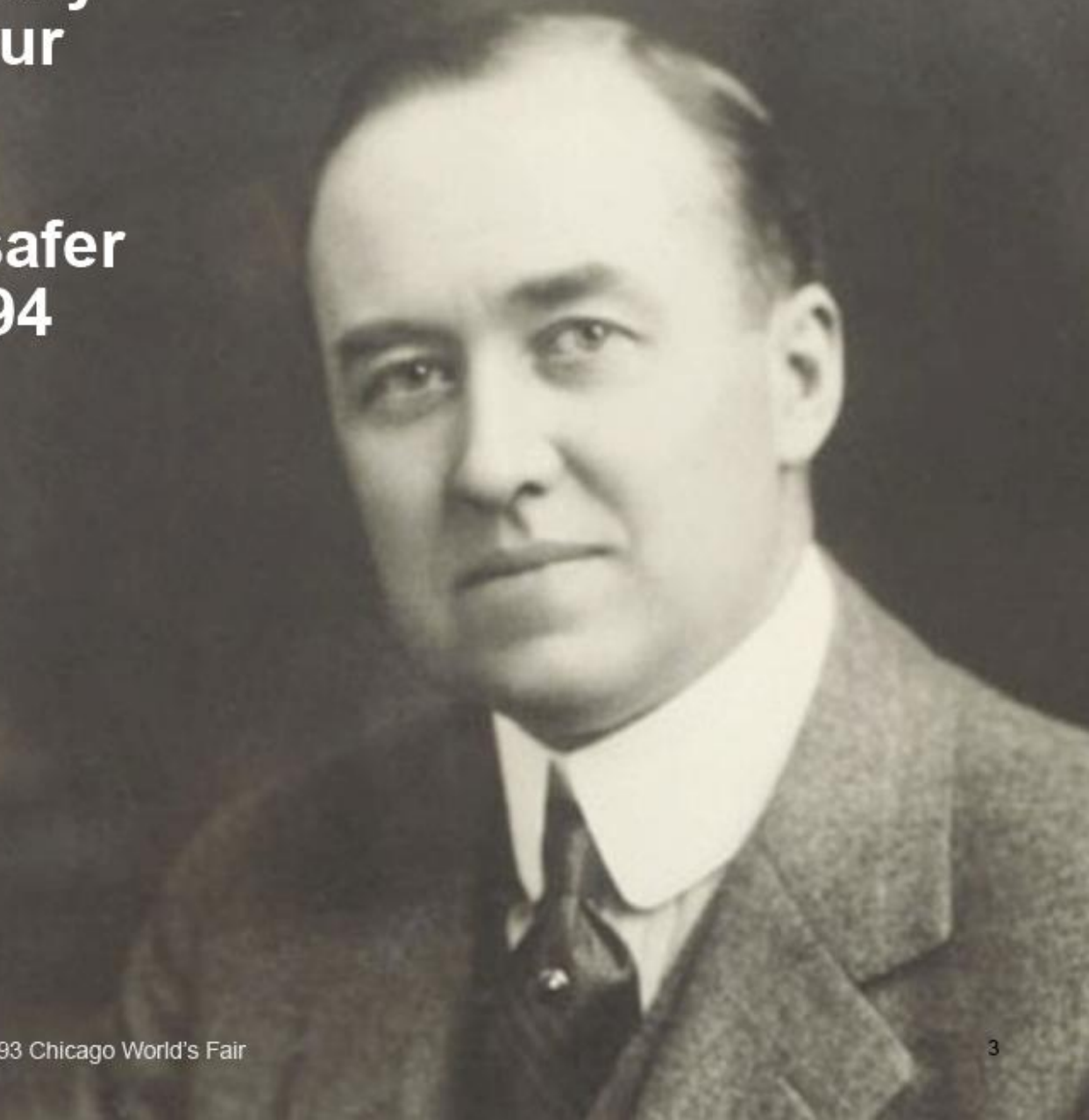


UL Environment Insights: Sustainability and Hi-Tech



**We are universally
committed to our
mission:**

**Working for a safer
world since 1894**



[illegible]

North American*

- San Francisco, CA
- Northbrook, IL
- Marietta, GA (headquarters)
- Ottawa, Canada

European Union*

- Cologne, Germany
- Frankfurt, Germany
- Milan, Italy
- Bangalore, India
- Guangzhou, China
- Tokyo, Japan

Japan*

Legend:

- Orange Pin = Sales Office
- Purple Pin = Testing Site

Certifications:

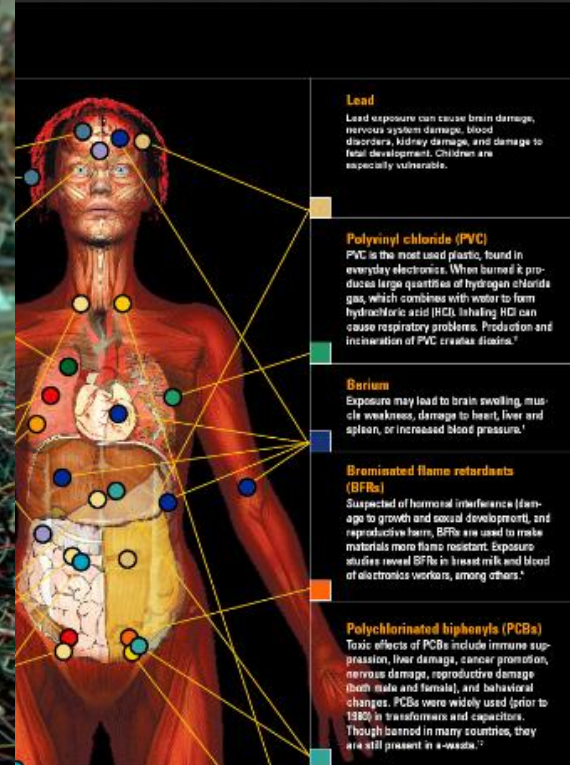
- North American:** UL-867, BIFMA International, CRI Green Label, CDPH California Department of Public Health, UL Validated, Greenguard, EcoLogo, Certified Environmental Product Declaration.
- European Union:** afset, DGNB, GUT, Das Kork-Logo, Organic Textile Standard, Natureplus, Eco Institut, Blue Angel, Ecolabel, CE, EN 14041, EN 14342, GBC, M, ECT, BB, A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z, AA, AB, AC, AD, AE, AF, AG, AH, AI, AJ, AK, AL, AM, AN, AO, AP, AQ, AR, AS, AT, AU, AV, AW, AX, AY, AZ, BA, BB, BC, BD, BE, BF, BG, BH, BI, BJ, BK, BL, BM, BN, BO, BP, BQ, BR, BS, BT, BU, BV, BW, BX, BY, BZ, CA, CB, CC, CD, CE, CF, CG, CH, CI, CJ, CK, CL, CM, CN, CO, CP, CQ, CR, CS, CT, CU, CV, CW, CX, CY, CZ, DA, DB, DC, DD, DE, DF, DG, DH, DI, DJ, DK, DL, DM, DN, DO, DP, DQ, DR, DS, DT, DU, DV, DW, DX, DY, DZ, EA, EB, EC, ED, EE, EF, EG, EH, EI, EJ, EK, EL, EM, EN, EO, EP, EQ, ER, ES, ET, EU, EV, EW, EX, EY, EZ, FA, FB, FC, FD, FE, FF, FG, FH, FI, FJ, FK, FL, FM, FN, FO, FP, FQ, FR, FS, FT, FU, FV, FW, FX, FY, FZ, GA, GB, GC, GD, GE, GF, GG, GH, GI, GJ, GK, GL, GM, GN, GO, GP, GQ, GR, GS, GT, GU, GV, GW, GX, GY, GZ, HA, HB, HC, HD, HE, HF, HG, HH, HI, HJ, HK, HL, HM, HN, HO, HP, HQ, HR, HS, HT, HU, HV, HW, HX, HY, HZ, IA, IB, IC, ID, IE, IF, IG, IH, II, IJ, IK, IL, IM, IN, IO, IP, IQ, IR, IS, IT, IU, IV, IW, IX, IY, IZ, JA, JB, JC, JD, JE, JF, JG, JH, JI, JJ, JK, JL, JM, JN, JO, JP, JQ, JR, JS, JT, JU, JV, JW, JX, JY, JZ, KA, KB, KC, KD, KE, KF, KG, KH, KI, KJ, KK, KL, KM, KN, KO, KP, KQ, KR, KS, KT, KU, KV, KW, KX, KY, KZ, LA, LB, LC, LD, LE, LF, LG, LH, LI, LJ, LK, LL, LM, LN, LO, LP, LQ, LR, LS, LT, LU, LV, LW, LX, LY, LZ, MA, MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MN, MO, MP, MQ, MR, MS, MT, MU, MV, MW, MX, MY, MZ, NA, NB, NC, ND, NE, NF, NG, NH, NI, NJ, NK, NL, NM, NN, NO, NP, NQ, NR, NS, NT, NU, NV, NW, NX, NY, NZ, OA, OB, OC, OD, OE, OF, OG, OH, OI, OJ, OK, OL, OM, ON, OO, OP, OQ, OR, OS, OT, OU, OV, OW, OX, OY, OZ, PA, PB, PC, PD, PE, PF, PG, PH, PI, PJ, PK, PL, PM, PN, PO, PP, PQ, PR, PS, PT, PU, PV, PW, PX, PY, PZ, QA, QB, QC, QD, QE, QF, QG, QH, QI, QJ, QK, QL, QM, QN, QO, QP, QQ, QR, QS, QT, QU, QV, QW, QX, QY, QZ, RA, RB, RC, RD, RE, RF, RG, RH, RI, RJ, RK, RL, RM, RN, RO, RP, RQ, RR, RS, RT, RU, RV, RW, RX, RY, RZ, SA, SB, SC, SD, SE, SF, SG, SH, SI, SJ, SK, SL, SM, SN, SO, SP, SQ, SR, SS, ST, SU, SV, SW, SX, SY, SZ, TA, TB, TC, TD, TE, TF, TG, TH, TI, TJ, TK, TL, TM, TN, TO, TP, TQ, TR, TS, TT, TU, TV, TW, TX, TY, TZ, UA, UB, UC, UD, UE, UF, UG, UH, UI, UJ, UK, UL, UM, UN, UO, UP, UQ, UR, US, UT, UU, UV, UW, UX, UY, UZ, VA, VB, VC, VD, VE, VF, VG, VH, VI, VJ, VK, VL, VM, VN, VO, VP, VQ, VR, VS, VT, VU, VV, VW, VX, VY, VZ, WA, WB, WC, WD, WE, WF, WG, WH, WI, WJ, WK, WL, WM, WN, WO, WP, WQ, WR, WS, WT, WU, WV, WW, WX, WY, WZ, XA, XB, XC, XD, XE, XF, XG, XH, XI, XJ, XK, XL, XM, XN, XO, XP, XQ, XR, XS, XT, XU, XV, XW, XX, XY, XZ, YA, YB, YC, YD, YE, YF, YG, YH, YI, YJ, YK, YL, YM, YN, YO, YP, YQ, YR, YS, YT, YU, YV, YW, YX, YY, YZ, ZA, ZB, ZC, ZD, ZE, ZF, ZG, ZH, ZI, ZJ, ZK, ZL, ZM, ZN, ZO, ZP, ZQ, ZR, ZS, ZT, ZU, ZV, ZW, ZX, ZY, ZZ.



The background of the slide is a light gray color with a repeating pattern of the text 'U_L' enclosed in thin gray circles, arranged in a grid.

Setting the stage

Awareness is up...



Lead

Lead exposure can cause brain damage, nervous system damage, blood disorders, kidney damage, and damage to fetal development. Children are especially vulnerable.

Polyvinyl chloride (PVC)

PVC is the most used plastic, found in everyday electronics. When burned it produces large quantities of hydrogen chloride gas, which combines with water to form hydrochloric acid (HCl). Inhaling HCl can cause respiratory problems. Production and incineration of PVC creates dioxins.²

Barium

Exposure may lead to brain swelling, muscle weakness, damage to heart, liver and spleen, or increased blood pressure.¹

Brominated flame retardants (BFRs)

Suspected of hormonal interference (damage to growth and sexual development), and reproductive harm, BFRs are used to make materials more flame resistant. Exposure studies reveal BFRs in breast milk and blood of electronics workers, among others.²

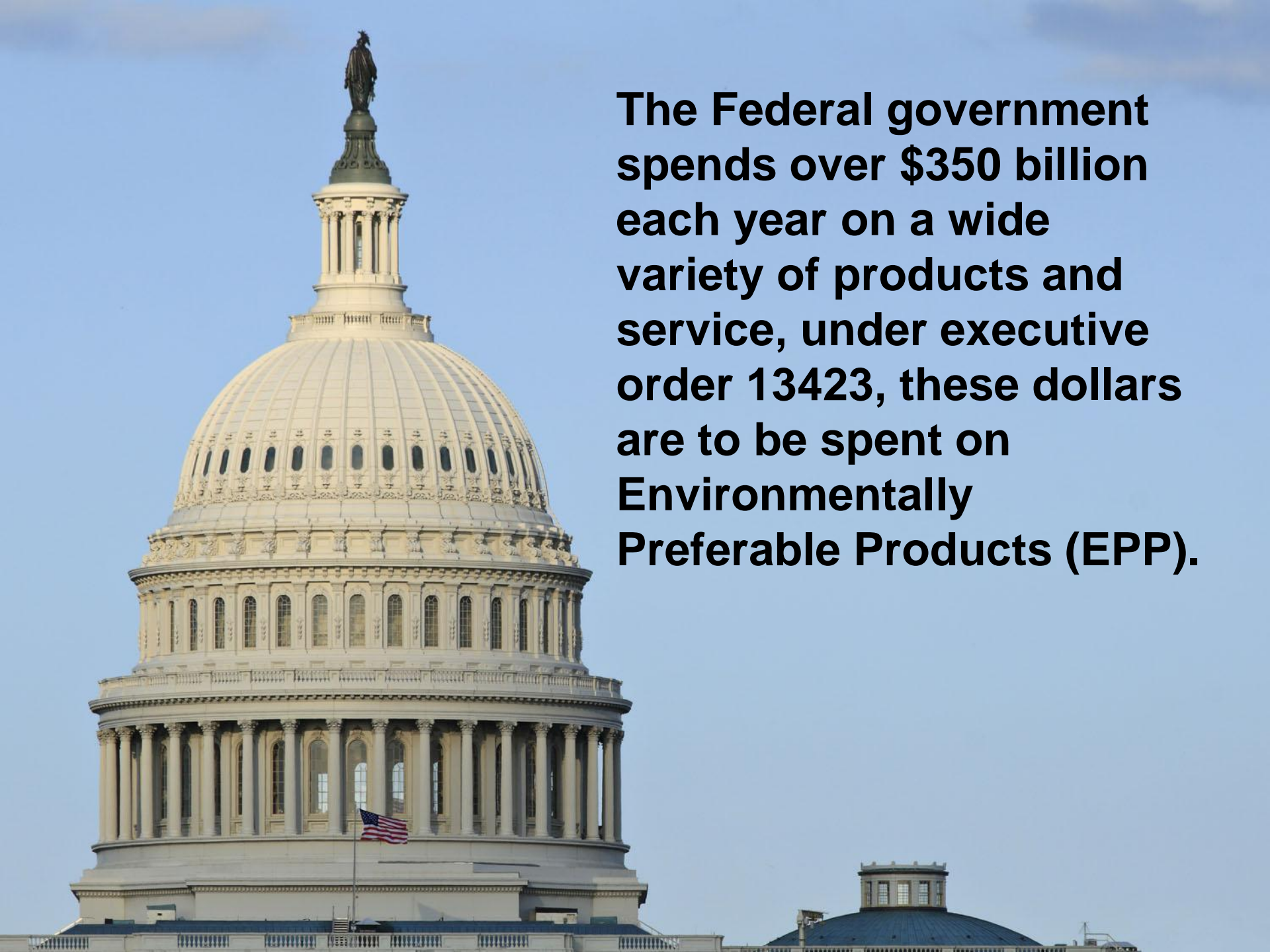
Polychlorinated biphenyls (PCBs)

Toxic effects of PCBs include immune suppression, liver damage, cancer promotion, nervous damage, reproductive damage (both male and female), and behavioral changes. PCBs were widely used prior to 1980 in transformers and capacitors. Though banned in many countries, they are still present in e-waste.²



Government and other procurement professionals are demanding green electronics.





The Federal government spends over \$350 billion each year on a wide variety of products and service, under executive order 13423, these dollars are to be spent on Environmentally Preferable Products (EPP).

Government and Universities

STATE AND MUNICIPAL GOVERNMENTS



California



Michigan



Colorado



Wisconsin



New York

....dozens of others (Illinois, Massachusetts, Minnesota, New Hampshire, New Jersey, Ohio, Pennsylvania, Rhode Island, Vermont, Washington DC.

...Municipal Government examples...Los Angeles County, Keene NH, Phoenix, AZ, Seattle, WA, and Leeds, UK

UNIVERSITIES

Of 300+ universities and colleges surveyed, 222 used EPEAT in their electronics purchasing decisions; of those, 70 purchased exclusively EPEAT-registered products (2010)

Some basics of Labeling

Types of Labels

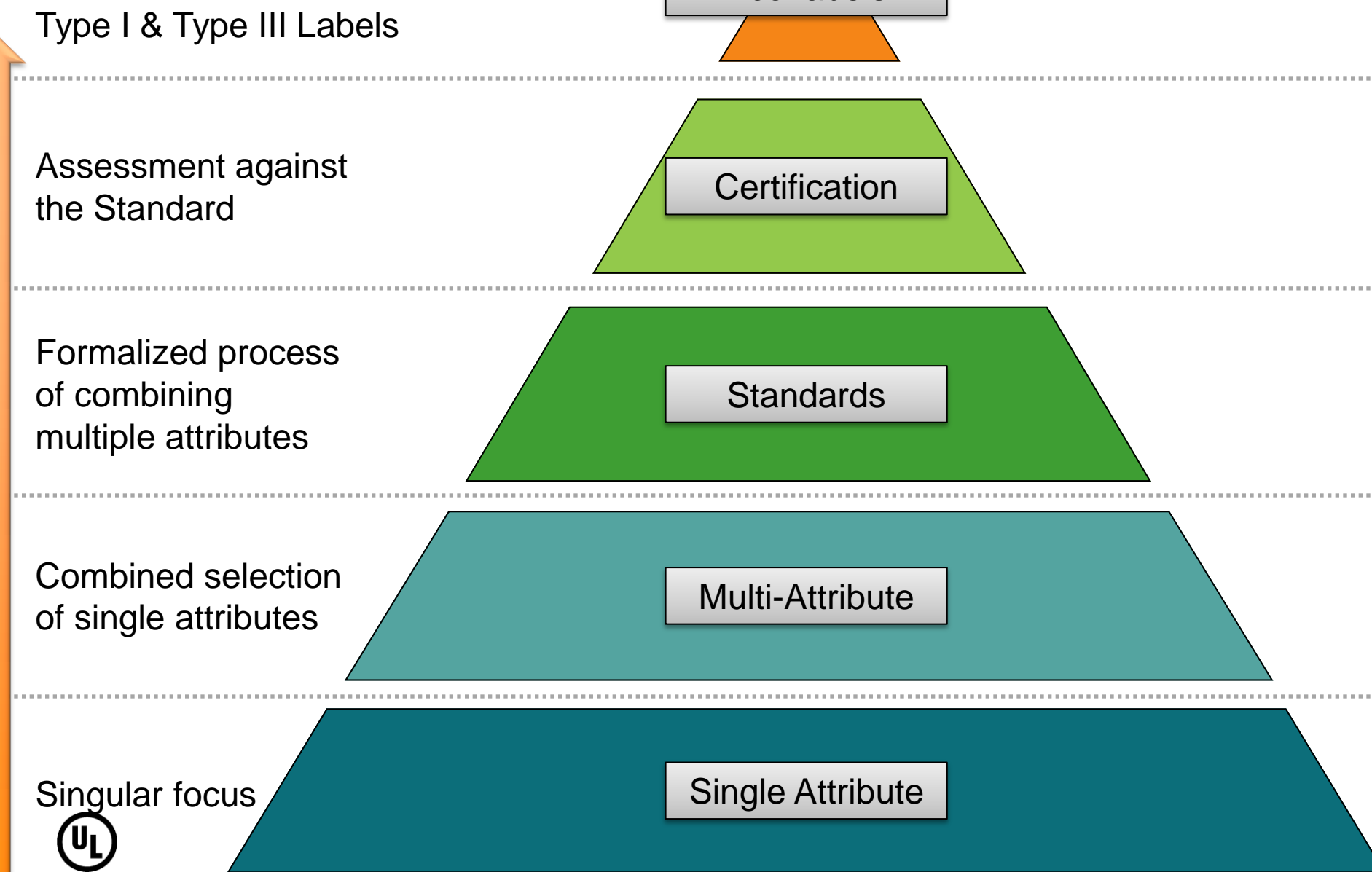


The ISO 14020 series (14020, 14021, 14024, and 14025) is designed to assist businesses with measuring and communicating their efforts to minimize their environmental impacts.

- Type I** Multi-attribute label developed by a third party
- Type II** Self declared label developed by the producer
- Type III** Life cycle assessment based communication tool for environmental performance data



Relationships Pyramid



The Trends

Performance Labels were the first step...

...Transparency is now the evolution

Presentation of product environmental impacts
Data calculated for product utilization of 20 years.

Environmental indicators	Unit	For a EasyPack 820/2000 SP			
		$G + M + D + U$	M	D	U
Raw Material Depletion	g-e	$3.33 \cdot 10^{-11}$	$3.37 \cdot 10^{-11}$	$1.37 \cdot 10^{-11}$	$2.57 \cdot 10^{-11}$
Energy Depletion	MJ	$2.88 \cdot 10^2$	$1.18 \cdot 10^2$	19.6	$2.67 \cdot 10^2$
Water Depletion	dm ³	$3.81 \cdot 10^2$	73.6	$1.86 \cdot 10^2$	$3.74 \cdot 10^2$
Global Warming Potential	g-CO ₂	$1.81 \cdot 10^2$	$6.37 \cdot 10^1$	$7.88 \cdot 10^1$	$1.88 \cdot 10^2$
Ozone Depletion	g-CFC-11	$2.26 \cdot 10^{-1}$	$1.43 \cdot 10^{-1}$	$6.18 \cdot 10^{-1}$	$2.23 \cdot 10^{-1}$
Photochemical Ozone Creation	g-C ₂ H ₄	$6.38 \cdot 10^2$	1.96	$7.84 \cdot 10^2$	$6.36 \cdot 10^2$
Air Acidification	g-H ⁺	$3.88 \cdot 10^2$	3.89	$1.48 \cdot 10^2$	$3.85 \cdot 10^2$
Hazardous Waste Production	kg	25.9	$4.88 \cdot 10^{-1}$	$6.28 \cdot 10^{-1}$	25.9

Increased TRANSPARENCY

- It used to be about downstream recycling
- Now, it is about Life Cycle Assessments (LCAs) through Environmental Product Declarations (EPDs)

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What is an EPD?

EPD

Environmental Product Declaration

A comprehensive, internationally-harmonized report that documents the ways in which a product, throughout its lifecycle, affects the environment. Considered an ISO Type III ecolabel, EPDs do not act as product ratings rather they help purchasers better understand a product's sustainable qualities and environmental impacts.



Environmental Product Declarations



EPDs deliver **transparency** into a product's environmental impacts, **from cradle-to-grave**.

An EPD is a summary of the Life Cycle Assessment in a form that is able to be communicated with consistency and credibility.

Typically, an EPD will include information about a product's impact on:

ATMOSPHERE



Global Warming Potential refers to long-term changes in global weather patterns – including temperature and precipitation – that are caused by increased concentrations of greenhouse gases in the atmosphere.



Ozone Depletion Potential is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.



Photochemical Ozone Creation Potential happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce a type of air pollution known as smog.

WATER



Acidification Potential is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – a phenomenon that pollutes groundwater and harms aquatic life.



Eutrophication Potential occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.

EARTH



Depletion of Abiotic Resources (Elements) refers to the reduction of available non-renewable resources, such as metals and gases, that are found on the periodic table of elements, due to human activity.



Depletion of Abiotic Resources (Fossil Fuels) refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.

The Characteristics of an EPD

Objective, based on internationally-accepted and valid methods for life cycle assessment (LCA) to identify and focus on the most significant environmental aspects leading towards continuous improvement.

Credible, critically reviewed, approved and maintained by an independent verifier.

Neutral, absent of claims of environmental preference, valuations and predetermined environmental performance levels.

Comparable, 'Product-Specific Requirements' (PCRs) for selected product groups and services, describe harmonized LCA-rules for data collection, methodology, calculations and presentation of the results.

Open to all products and services, through its neutral character and non-selectivity, it has the widest range of applicability to all products and services.

Open to all interested parties, through easy access on the Internet.

Environmental impact-oriented, through the possibility to include assessments of potential environmental impacts.

Instructive, explain terms, definitions and concepts, as well as general information on relevant environment issues to help in the interpretation of the information.



The Utility of EPDs

Management tool for manufacturers, purchasers, the procurement and purchases functions of an organization, for product designers and for marketing strategy - by monitoring the product data and applying the outcomes to improve environmental performance.

Communication tool among manufacturers, suppliers, distributors, purchasers, contractors, and users by functioning as a source of environment information, while enhancing environmental awareness and interacting with internal environmental concerns.

Evaluation/Assessment tool for professionals, procurement, contractors and buyers - by using the EPD for making decision and for bench-marking environmental information.

Procurement tool for government, commercial and institutional purchasers.

Action tool for consumers and consumer groups by disseminating environmental information and product criteria, making comments, and asking for disclosure of consumer concerns.



Two Primary Components of EPDs

LIFE CYCLE ASSESSMENT

Life Cycle Assessment (LCA) is the technique used to **assess environmental impacts associated with all the stages** of a product's life from-cradle-to-grave (i.e., from raw material extraction through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling). LCAs can **help avoid a narrow outlook** on environmental concerns by:

- Compiling an inventory of **relevant energy and material inputs** and environmental releases;
- Evaluating the **potential impacts** associated with identified inputs and releases;
- Interpreting the results to help make **a more informed decision**.



Two Primary Components of EPDs

PRODUCT CATEGORY RULES

Product Category Rules (PCRs) are a set of **rules, requirements and guidelines** for developing Environmental Product Declarations (EPDs) for one or more product categories.

- ✓ A Product Category is a **group of products** that can fulfill equivalent functions - for example, 'floor finishes,' 'concrete blocks' or 'insulation'
- ✓ PCRs are particularly useful when the environmental impacts of products within a category group are to be compared - perhaps as part of a product specification process. **Rules provide a level playing field** for comparison of products.





WITHOUT environmental product declarations
comparing life cycle assessments you would be
comparing...

...because there are **no** instructions and guidelines
on how to complete the assessment.



...but **WITH** environmental product declarations,
comparing life cycle assessments is like comparing...

guidelines ...because the **instructions &**
allow for comparable assessments of
products in the same category

Importance of Product Category Rules

Environmental Product Declaration

Final Assessment & Declaration
based on the PCR and the
Standards

Life Cycle Assessment

Product Category Rules

Product Specific Rules for LCA & EPD

ISO 14025

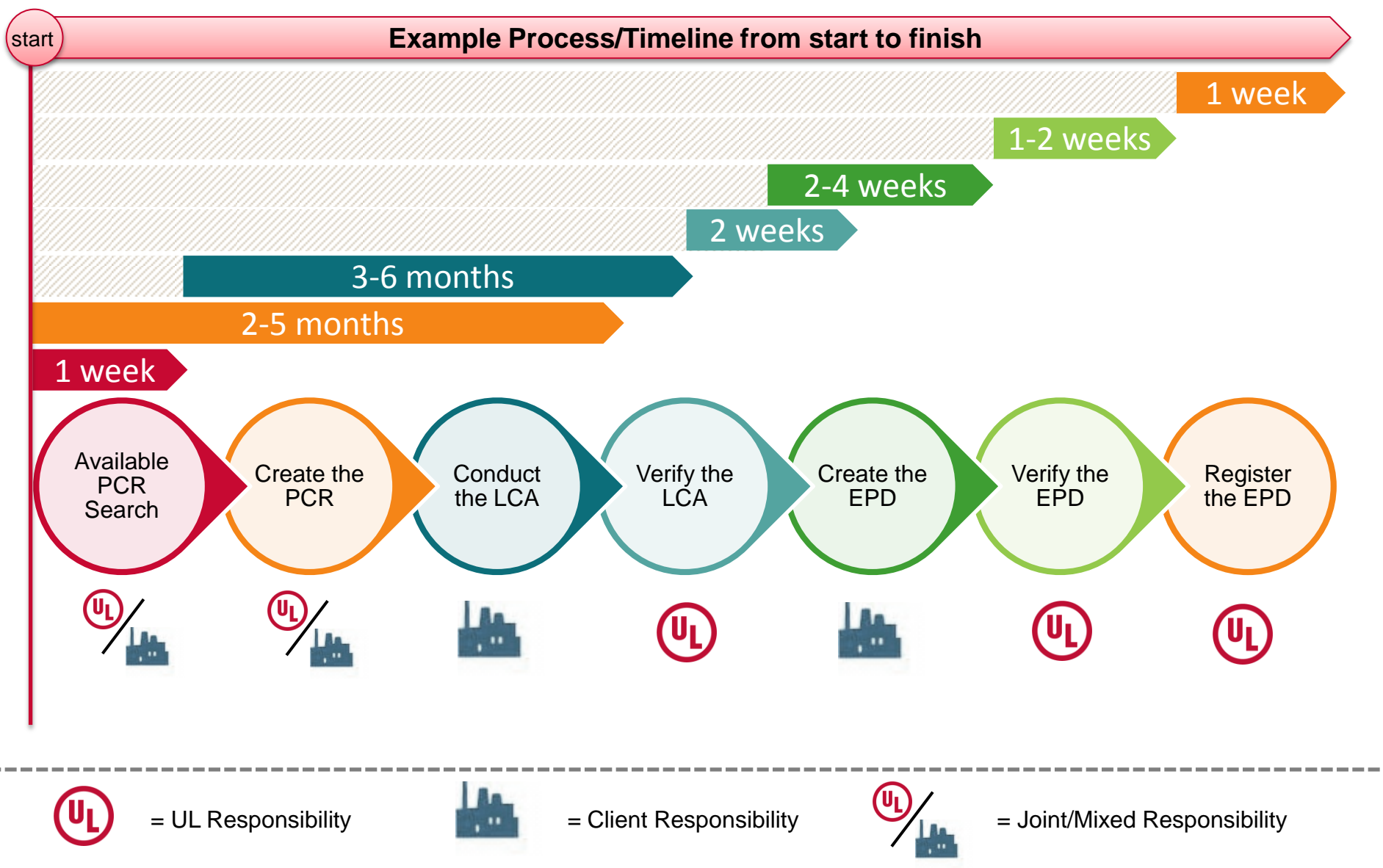
General Methods for EPD

ISO 14040/44

General Methods for LCA

UL Environment

Basic EPD Process & Timeline



The Program Operator ...



UL Environment is designated as a Program Operator, administering the program, facilitating the appropriate processes and ensuring credibility.

Meet the EPD

ENVIRONMENTAL PRODUCT DECLARATION

SAMSUNG SMART TV LED 8 SERIES



Samsung SMART TV LED 8 series
Experience the future of TV



At Samsung, we believe it's our responsibility to do business in a way that enriches our planet.

That's why we carry out a wide range of environmental activities all around the world. We're the leader in delivering innovative eco-friendly products to consumers and are committed to product stewardship throughout the entire life cycle of our products.

Everything we do is guided by our focus on the "greening" of management, products, processes and communities. Our green management policy guides and supports the continuous enhancement of greener environment through all of our business activities including product design, manufacturing process and workplace operations.



DECLARATION

Page 1 of 17

According to ISO 14025

Declaration in accordance with ISO 14025 that describes the environmental product. It promotes the development of the product and all relevant environmental information is



Electronics
1
Series Smart TV
Rules for Preparing an Environmental Product Declaration for TFT-LCD (Prepared by AU Optonics Corporation, Taiwan ROC, February 2010)

Information and information about building physics
of basic material and the material's origin
of the product's manufacture
of the product's processing
of the product's conditions
of the product's results
of the product's verifications

AU Optonics Corp. (AUC) and Taiwan Electrical and Electronic Manufacturers Association (TEEMA)
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Email: lynda.chang@auc.com

Lynda Chang
Lynda Chang

Sarah Boyd

This declaration was independently verified in accordance with ISO 14025 by Underwriters Laboratories
☐ INTERNAL ☒ EXTERNAL

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR by:

Sarah Boyd

Environment



ENVIRONMENTAL PRODUCT DECLARATION

LG CINEMA 3D SMART TV

LG ELECTRONICS
LG 55LA6900



LG's innovative technologies, unique products, and cutting-edge designs are an investment in the future.

LG Electronics, Inc. is a global leader and technology innovator in consumer electronics, mobile communications and home appliances.

With its operations around the world, LG is comprised of four business units - Home Entertainment, Mobile Communications, Home Appliances, and Air Conditioning & Energy Solutions - and is one of the world's leading producers of flat panel TVs, mobile devices, air conditioners, washing machines and refrigerators.

For more information visit
www.lge.com



According to ISO 14025

Declaration in accordance with ISO 14025 that describes the product. It promotes the development of sustainable product and all relevant environmental information is disclosed.



Rules for Preparing an Environmental Product Declaration (EPD) for TFT-LCD (Prepared by AU Optonics Corporation, Taiwan ROC, February 2010)

Information and information about building physics
of basic material and the material's origin
of the product's manufacture
of the product's processing
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Lynda Chang
Lynda Chang

Sarah Boyd

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☐ INTERNAL ☒ EXTERNAL

This life cycle assessment was independently verified in accordance with ISO 14044 and the reference PCR

Sarah Boyd, PE International

Environment



Meet the EPD

MATERIALS AND DESCRIPTIONS



UN55D8000YF
SAMSUNG SMART LED TV

According to ISO 14025

List of Parts and Banned Substances

The following table outlines the main components of the product (includes all parts and substances that have a weight ratio (part weight/product weight) $\geq 0.5\%$).

Parts name	Substances
CHASSIS-BOTTOM	Aluminum
LGP-LED	Polymethyl methacrylate
TFT-LCD panel	TFT-LCD
COVER-REAR	Carbon Steel
BRACKET-STAND,NECK	Aluminum
BRACKET-STAND,FRONT	HGI
COVER-STAND,BASE	Polystyrene
COVER-MIDDLE	Polycarbonate
PCB Power board	Printed circuit board
GUIDE STAND	Polycarbonate
PCB MAIN board	Printed circuit board
BOX-01,SET OUT	Corrugated cardboard
CUSHION-SET	Expanded polystyrene

Functional Unit

The functional unit is defined as one unit of TFT-LCD television for the domestic Korean market.

System Boundaries

The Life Cycle Assessment includes all relevant cradle-to-grave environmental information for a television. The system boundaries include raw material production and processing, main component manufacturing, assembly of a TV, packaging, transportation, energy usage, as well as the end-of-life options (recycling, incineration for landfill disposal). The system boundaries of the product system are presented as follows:

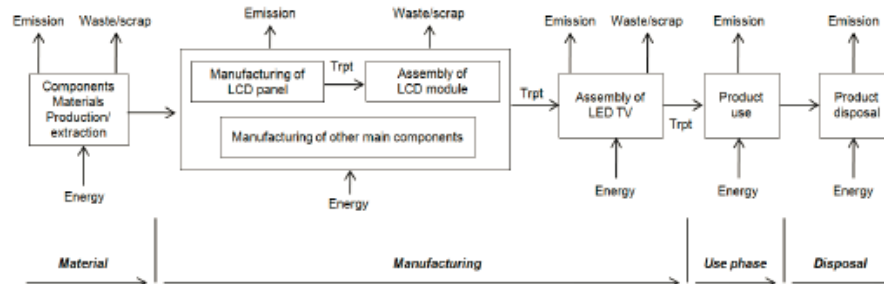


Figure 1: System boundary of the product system.

Environment



Meet the EPD

ENVIRONMENTAL IMPACTS

ENVIRONMENTAL PRODUCT DECLARATION

6



LG 55LA6900
LG Cinema 3D Smart TV

According to ISO 14025

Life Cycle Impact Assessment

The target system was assessed by using the eco-indicators developed by the Ministry of Knowledge Economy (Ministry of Knowledge Economy, Korea), as shown in tables and figure below.

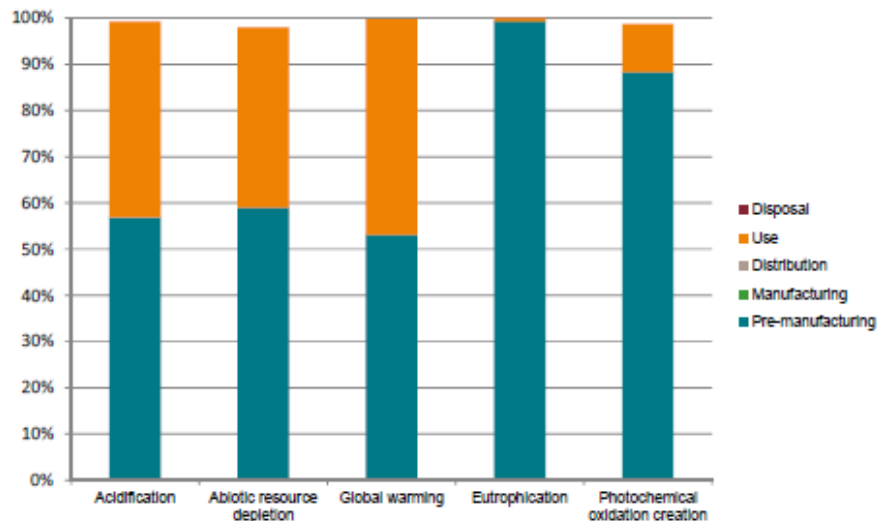
The potential impacts per life cycle stage

Impact category	Unit	Total	Pre-manufacturing	Manufacturing	Distribution	Use	Disposal
Acidification	kg SO ₂	4.56.E+00	2.63.E+00	5.26.E-04	5.98.E-03	1.96.E+00	-3.61.E-02
Abiotic resource depletion	1/yr	9.99.E+00	6.15.E+00	1.09.E-03	4.28.E-03	4.05.E+00	-2.19.E-01
Global warming	kg CO ₂	2.48.E+03	1.33.E+03	3.12.E-01	5.11.E-01	1.16.E+03	-6.35.E+00
Eutrophication	kg PO ₄ -P	5.15.E+01	5.11.E+01	9.81.E-05	1.06.E-03	3.65.E-01	-6.85.E-03
Photochemical oxidation creation	kg Ethylene	8.18.E-01	7.43.E-01	2.32.E-05	2.81.E-04	8.65.E-02	-1.13.E-02

Percentage of the environmental impact of the stage to the impact category

Impact category	Pre-manufacturing	Manufacturing	Distribution	Use	Disposal
Acidification	57.64%	0.01%	0.13%	43.01%	-0.79%
Abiotic resource depletion	61.55%	0.01%	0.04%	40.59%	-2.20%
Global warming	53.44%	0.01%	0.02%	46.78%	-0.26%
Eutrophication	99.30%	0.00%	0.00%	0.71%	-0.01%
Photochemical oxidation creation	90.78%	0.00%	0.03%	10.57%	-1.39%

Percentage of the environmental impacts of the stages to the impact category



A man in a white shirt and tie is holding a transparent sign in front of his face. The sign has handwritten text in black ink. The man's face is blurred behind the sign.

Transparency
is The New
Green.



Thank You!

Contact Information

Mark Rossolo

Mark.Rossolo@ul.com