International Card Manufacturers Association – Indicators for the Environmental Impact of Cards

Contents

Tables

Figures

Annex

Foreword

This document is part of a set of standards issued by the International Card Manufacturers Association to provide guidance to the card industry for the purpose of declaring the environmental impact of card products and the issuance of environmental labels for such purposes and for the indication of the level of compliance to this standard .

This standard provides an agreed upon set of indicators.

Another document, the “ICMA EcoLabel Manual”, is a part of this set of standards and provides guidance about the use of this document.

1. SCOPE

This International Card Manufacturers Association Standard describes meaningful and understandable criteria for the measurement and comparison of parameters that determine the environmental impact of cards that will be supported by the card industry.

2. NORMATIVE REFERENCES

The following references constitute provisions of this International Card Manufacturers Association Standard. At the time of publication, the editions indicated were valid. All references are subject to revision and interested parties are encouraged to assess the impact of updated revisions.

Document	Title
ISO 14020	Environmental labels and declarations — General Principles
ISO 14021	Environmental labels and declarations —Self-declared environmental claims (Type II environmental labeling)
ISO/IEC 7810:2003	2.1.1. Identification cards - Physical characteristics
ISO 14024:2001	Environmental labels and declarations —Type I environmental labeling – Principles and procedures
ISO 14025:2006	Environmental labels and declarations —Type III environmental declarations – Principles and procedures
ISO 472	Plastics — Vocabulary
ISO 14851:1999 Cor 1:2005	Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium -- Method by measuring the oxygen demand in a closed respirometer
ISO 14852:1999 Cor 1:2005	2.1.2. Determination of the ultimate aerobic biodegradability of plastic materials in an aqueous medium -- Method by analysis of evolved carbon dioxide
ISO 14855-1	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide — Part 1: General method
ISO 14855-2	Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions — Method by analysis of evolved carbon dioxide — Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test
ISO 16929	Plastics — Determination of the degree of disintegration of plastic materials under defined composting conditions in a pilot-scale test
ISO 17088:2012	Specifications for compostable plastics

ISO 17556:2012	2.1.3. Plastics - Determination of the ultimate aerobic biodegradability in soil by measuring the oxygen demand in a respirometer or the amount of carbon dioxide evolved
ISO 20200:2004	Plastics — Determination of the degree of disintegration of plastic materials under simulated composting conditions in a laboratory-scale test
EN 13432:2000	Packaging — Requirements for packaging recoverable through composting and biodegradation — Test scheme and evaluation criteria for the final acceptance of packaging
ASTM D 5338	Standard Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions
ASTM D 6400	Standard Specification for Compostable Plastics
OECD Guideline 208	OECD Guidelines for the Testing of Chemicals — Guideline 208: Terrestrial Plants, Growth Test

3. DEFAULT TEST ENVIRONMENT AND CONDITIONING

Unless otherwise specified, the environment for the tests specified within this Standard shall be 23°C ± 3°C (73°F ± 5°F) and 40% to 60% relative humidity. Condition test cards at the designated temperature and humidity for a period of 24 hours before testing.
Cards shall be free of any contamination that could affect test results. Examples include, but are not limited to finger oils, rubber band residue and particles from card processing.

4. DEFINITIONS

4.1. Biodegradable: A characteristic of a product or packaging that, with respect to specific conditions, allows it to break down through biologic activity to a specific extent within a given time**.**

4.2. Biodegradable during composting: Synonymous with "compostable" (see definition of "compostable plastic")**.**

4.3. Catalyst: Substance, used in small proportion, that augments the rate of a chemical reaction and, in theory, remains unchanged chemically at the end of the reaction**.**

4.4. Compost: Organic soil conditioner obtained by biodegradation of a mixture consisting principally of vegetable residues, occasionally with other organic material and having a limited mineral content**.**

4.5. Compostable: A characteristic of a product, packaging or associated component that allows it to biodegrade, generating a relatively homogeneous and stable humus-like substance**.**

4.6. Compostable plastic: Plastic that undergoes degradation by biological processes during composting to yield CO2, water, inorganic compounds and biomass at a rate consistent with other known compostable materials and leave no visible, distinguishable or toxic residue**.**

4.7. Composting: Aerobic process designed to produce compost.

4.8. Degradable: A characteristic of a product or packaging that, with respect to specific conditions, allows it to break down to a specific extent within a given time.

4.9. Designed for disassembly: A characteristic of a product's design that enables the product to be taken apart at the end of its useful life in such a way that allows components and parts to be reused, recycled, recovered for energy or, in some other way, diverted from the waste stream.

4.10. Disintegration: Physical breakdown of a material into very small fragments.

4.11. Extended life product: A product designed to provide prolonged use, based on either improved durability or an upgradability feature, that results in reduced resource use or reduced waste.

4.12. Filler: Relatively inert solid material added to a plastic to modify its strength, permanence, working properties or other qualities, or to lower costs.

4.13. Recovered energy: A characteristic of a product that has been made using energy recovered from material or energy that would have been disposed of as waste but instead has been collected through managed processes.

4.14. Recovered (reclaimed) material: Material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and recovered [reclaimed] as a material input, in lieu of new primary material, for a recycling or a manufacturing process.

NOTE: For the purposes of this standard, the expressions "recovered material" and "reclaimed material" are treated as synonyms; however, it is recognized that, in some countries, one or other of these expressions may be preferred for this application.

4.15. Recyclable: A characteristic of a product, packaging or associated component that can be diverted from the waste stream through available processes and programs and can be collected, processed and returned to use in the form of raw materials or products.

4.16. Recycled content: Proportion, by mass, of recycled material in a product or packaging. Only pre-consumer, post-consumer, or post-industrial materials shall be considered as recycled content, consistent with the following usage of terms.

4.16.1. Pre-consumer material: Material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

4.16.2. Post-consumer material: Material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

4.16.3. Post-industrial material: Material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

NOTE: For the purposes of this standard, the expressions “pre-consumer material” and “post-industrial material” are treated as synonyms; however, it is recognized that, in some countries, one or other of these expressions may be preferred for this application.

4.17. Recycled material: Material that has been reprocessed from recovered [reclaimed] material by means of a manufacturing process and made into final product or into a component for incorporation into a product.

4.18. Reduced energy consumption: Reduction in the amount of energy associated with the use of a product performing the function for which it was conceived when compared with the energy used by other products performing an equivalent function.

4.19. Reduced resource use: A reduction in the amount of material, energy or water used to produce or distribute a product or packaging or specified associated component. NOTE: For the purposes of this standard, only reduced plastic content is being addressed. Future revisions may include standards for claims of source reduction related to other factors, such as reduced energy or material waste during manufacture.

4.20. Reduced water consumption: Reduction in the consumption of water associated with the use of a product performing the function for which it was conceived when compared with the amount of water used by other products performing an equivalent function.

4.21. Refillable: A characteristic of a product or packaging that can be filled with the same or similar product more than once, in its original form and without additional processing except for specified requirements such as cleaning or washing.

4.22. Reusable: A characteristic of a product or packaging that has been conceived and designed to accomplish within its life cycle a certain number of trips, rotations or uses for the same purpose for which it was conceived.

4.23. Standard ID card: Unpersonalized card meeting the criteria for physical characteristics detailed in ISO/IEC 7810.

4.24. Theoretical amount of evolved carbon dioxide, ThCO2: Maximum theoretical amount of carbon dioxide evolved after completely oxidizing a chemical compound, calculated from the molecular formula and expressed as milligrams of carbon dioxide evolved per milligram or gram of test compound.

4.25. Total dry solids: Amount of solids obtained by taking a known volume of test material or compost and drying it at about 105 °C to a constant mass.

4.26. Ultimate aerobic biodegradation: Breakdown of an organic compound by microorganisms in the presence of oxygen into carbon dioxide, water and mineral salts of any other elements present (mineralization) plus new biomass.

4.27. Volatile solids: Amount of solids obtained by subtracting the residue of a known volume of test material or compost after incineration at about 550 °C from the total dry solids of the same sample.

NOTE: The volatile-solids content is an indication of the amount of organic matter present.

4.28. **Waste reduction:** Reduction in the quantity (mass) of material entering the waste stream as a result of a change in the product, process or packaging.

5. ENVIRONMENTAL LABELING PRINCIPLES

In accordance with ISO 14020, characteristics and criteria presented in this standard are intended to comply with the following principles:

Principle 1: Environmental labels and declarations shall be accurate, verifiable, relevant and not misleading.

The usefulness and effectiveness of environmental labels and declarations depend upon the extent to which they convey reliable and meaningful information about the environmental aspects of a product or service. Environmental labels and declarations shall provide accurate information about the environmental aspects of a product or service. The factual and technical basis for environmental labels and declarations shall be verifiable. Environmental labels and declarations shall provide information that is relevant; they shall address only nontrivial environmental aspects related to the actual circumstances of natural resource extraction, manufacture, distribution, use or disposal associated with the product or service. A periodic review of the basis for environmental labels and declarations should occur to account for innovation. Information should be gathered at a frequency consistent with the pace of innovation. Environmental labels and declarations shall be understandable and not likely to mislead the intended purchaser of the product or service.

Principle 2: Procedures and requirements for environmental labels and declarations shall not be prepared, adopted, or applied with a view to, or with the effect of, creating unnecessary obstacles to international trade.

For guidance on the above principle, the applicable provisions and interpretations of the World Trade Organization should be taken into account.

Principle 3: Environmental labels and declarations shall be based on scientific methodology that is sufficiently thorough and comprehensive to support the claim and that produces results that are accurate and reproducible.

The information supporting environmental labels and declarations shall be gathered and assessed using methods that are recognized and widely accepted in scientific or professional disciplines or are otherwise scientifically defensible. The methods should follow recognized standards that have international acceptability (these may include international, regional or national standards) or be industry or trade methods that have been subjected to peer review, where such standards or methods exist. The methods used shall be appropriate to the claim and shall provide information that is relevant, accurate, reproducible and necessary to support the claim.

Principle 4: Information concerning the procedure, methodology, and any criteria used to support environmental labels and declarations shall be available and provided upon request to all interested parties.

The information shall include underlying principles, assumptions and boundary conditions. This information should be sufficient and reasonably comprehensible to allow purchasers, potential purchasers and other interested parties to evaluate and compare environmental labels and declarations in terms of scientific principles, relevance and overall validity, and to assess whether an environmental label or declaration is consistent with the applicable standards within the ISO 14020 series. This information shall also clearly indicate whether the environmental label or declaration is a self-declared environmental claim or is based on independent validation. The means of obtaining this information shall be made known to purchasers and potential purchasers wherever the product or service is marketed. This can be achieved by the various means discussed in 4.10. There may be limits to the availability of specific information due to confidential business information, intellectual property rights or similar legal restrictions.

Principle 5: The development of environmental labels and declarations shall take into consideration all relevant aspects of the life cycle of the product.

The life cycle of a product or service ranges from activities associated with the production and delivery of raw materials or generation of natural resources to the final disposal. Consideration of the life cycle of a product or service allows a party developing an environmental label or declaration to take into account a range of factors that impact on the environment. It further allows that party to identify the potential for one impact to be increased in the process of decreasing another. Consideration should be given to the life cycle of a product or service in order to help identify appropriate and relevant characteristics and criteria for environmental labels and declarations or to determine the significance of an environmental claim. The extent to which the life cycle is considered may vary depending on the type of environmental label or declaration, the nature of the claim and the product category. This does not necessarily mean that a life cycle assessment should be undertaken.

Principle 6: Environmental labels and declarations shall not inhibit innovation that maintains or has the potential to improve environmental performance.

Requirements shall be expressed in terms of performance rather than design or descriptive characteristics. This approach leaves maximum flexibility for technical or other innovation. Prescriptive design criteria or implicit preference for a technology should be avoided because of the possibility of restricting or discouraging improvements in products or services which do not affect conformance to applicable environmental criteria or which could lead to significant environmental improvement.

Principle 7: Any administrative requirements or information demands related to environmental labels and declarations shall be limited to those necessary to establish conformance with applicable criteria and standards of the labels and declarations.

All organizations, regardless of size, should have equal opportunity to use environmental labels and declarations. Involvement should not be hindered by extraneous factors or requirements such as procedural complexity or unreasonable information or administrative demands.

Principle 8: The process of developing environmental labels and declarations should include an open, participatory consultation with interested parties. Reasonable efforts should be made to achieve a consensus throughout the process.

The process for developing standards and criteria shall be open to all interested parties. The parties shall be invited to participate and encouraged to become involved through timely and adequate notification. Parties may choose to participate directly or through other means such as written or electronic correspondence. Comments and input shall be responded to in a meaningful way that addresses the substance of the comment or input. For self declared environmental claims developed in accordance with ISO 14021, consultation is regarded as having occurred during the development of that International Standard.

Principle 9: Information on the environmental aspects of products and services relevant to an environmental label or declaration shall be available to purchasers and potential purchasers from the party making the environmental label or declaration.

Ultimately, the effectiveness of environmental labels and declarations depends on their ability to enable purchasers and potential purchasers to take responsibility for, and make informed choices about, the environmental aspects of their purchasing decisions and to influence purchasers and potential purchasers in their selection of products or services. This, in turn, is related to the degree of acceptance and understanding purchasers and potential purchasers have of the information provided about environmental aspects. Therefore, parties using environmental labels and declarations have an incentive and a responsibility to provide their purchasers and potential purchasers with access to information so that the purchaser and potential purchaser may understand the meaning of any claim, symbol or term. This can be accomplished through various means, such as advertising, explanatory panels at the retail level, free telephone numbers, and education programs, among others. The information provided shall be appropriate and sufficient to the nature and scope of the environmental claim being made.

6. SUSTAINABILITY

6.1. Definition

Sustainability is: meeting the needs of the present without compromising the ability of future generations to meet their own needs. This involves addressing economic, social and environmental factors and their interdependence in an organization’s decision-making and activities.[1]

Achieving sustainability is often defined through achieving sustainability's so called 3 pillars - economic, social and environmental:

6.1.1. Economic Sustainability

Promote a prosperous, innovative, knowledge-rich, competitive and eco-efficient economy which provides high living standards and full and high-quality employment.

[1] 1987 Brundtland Commission

6.1.2. Social Sustainability

"Promote a democratic, socially inclusive, cohesive, healthy, safe and just society with respect for fundamental rights and cultural diversity that creates equal opportunities and combats discrimination in all its forms."

6.1.3. Environmental Sustainability

Safeguard the earth's capacity to support life in all its diversity, respect the limits of the planet's natural resources and ensure a high level of protection and improvement of the quality of the environment. Prevent and reduce environmental pollution and promote sustainable consumption and production to break the link between economic growth and environmental degradation. Typical indicators commonly given for Environmental Sustainability are:

- Climate change
- Resource use
- Biodiversity

This document focuses on the environmental sustainability of plastic card products like those defined in the international standard ISO/IEC7810 or similar products.

7. ECO PROFILES FOR CARD PRODUCTS

7.1. Life Cycle Assessment

To address environmental sustainability it is important to understand the meaning of some terms related to the concept of Life Cycle Assessment:

7.1.1. Life Cycle

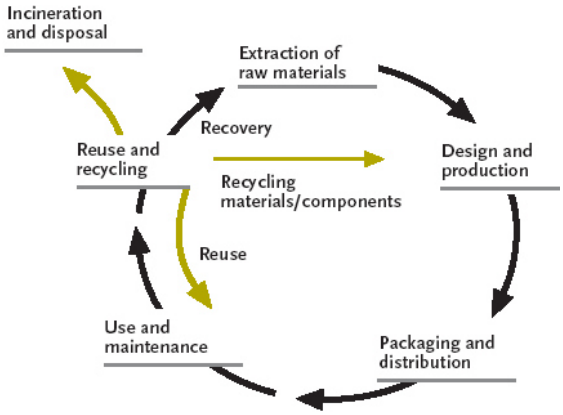

Figure 1. Life Cycle

The ISO 14040 series defines the life cycle as: *"consecutive and interlinked stages of a product system, from raw material acquisition or generation from natural resources to final disposal"*. It can usefully be referred to as a 'cradle-to-grave' process and can be visualized as above. Genuine environmental improvements require a life cycle thinking approach to product and packaging systems.

7.1.2. Life Cycle Thinking ("LCT")

The United Nations Environmental Programme has proposed that: “the purpose of life cycle thinking is to prevent piecemeal approaches and avoid problem shifting from one life cycle stage to another, from one geographic area to another, and from one environmental medium to another”[2].

7.1.3. Life Cycle Assessment ("LCA")

This involves a more rigorous quantitative process than LCT and is the predominant tool used to substantiate the benefits of LCT for goods and services in terms of environmental impacts. It involves careful *“compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle”* [3] and within a given set of boundary conditions. The ISO 14040 series of standards are the reference source for the life cycle assessment technique and include the requirements for their proper conduct. Impacts assessed include greenhouse gases (see below), acidification, eutrophication, resource depletion, primary energy, waste and toxicity.

7.1.4. Life Cycle Inventory

The Life Cycle Inventory provides the basic data to perform a life cycle assessment.

7.2. The Life Cycle of Plastic Cards

The following figure shows a Simplified Lifecycle of Plastic Cards.

[2] United Nations Sustainable Production and Consumption Branch. *Life Cycle Management a Business Guide to Sustainability.* Paris: UNEP – www.unep.fr/scp/publications, 2007.
[3] *ISO 14040 Environmental management. Life cycle assessment. Principles and framework.*

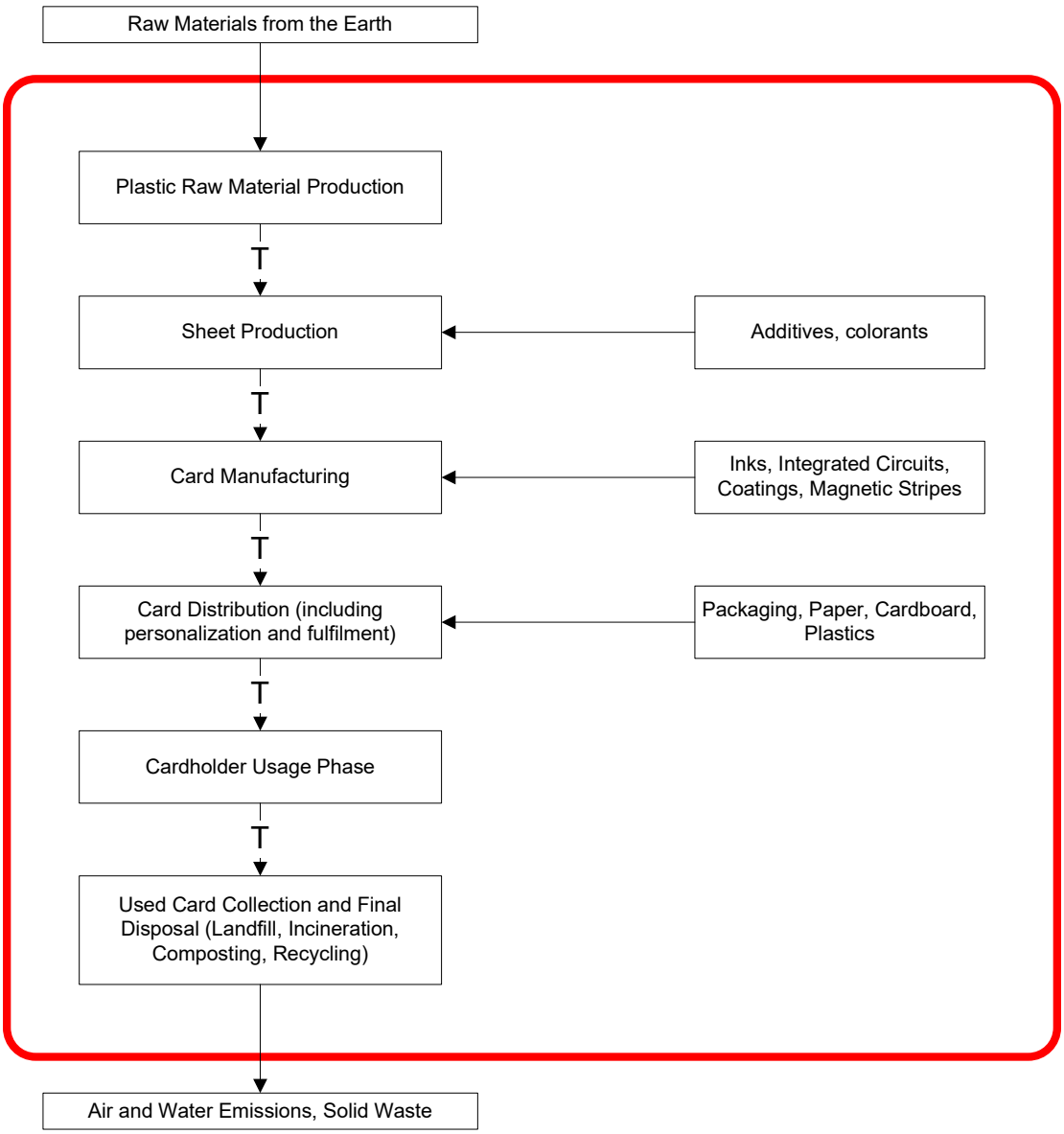

Figure 2. Simplified Plastic Card Life Cycle

Figure 2 starts with the extraction of resources from the earth, such as crude oil and gas, and ends with the final disposal of the cards used. The life cycle starts with the production of the raw materials for the card body from fossil or bio based resources followed by sheet production and card manufacturing. The "T" stands for the transportation between the various life cycle steps. During sheet production and card manufacturing the complexity increases by the use of additives and colorants and by the use of inks, Integrated Circuits, coatings and magnetic stripes respectively. This complexity of the life cycle increases further as a result of the worldwide distribution of cards and use of the required packaging materials and card documentation. Also the fact that there are multiple raw materials, sheet producers, card manufacturers and distributors significantly increases the complexity of the life cycle of cards. After distribution the cards are used by the consumer and typically disposed of through landfill or incineration. Other possibilities for the end of life of the card include composting and recycling. The boundary of the life cycles is given by the red line in Figure 2. Simplified Plastic Card Life

Cycle. The materials entering this system are the raw materials extracted from the earth; the final materials leaving this system are air and water emissions and final solid waste produced.

This all means that we are dealing with a complex system that is rather difficult to model in one single Life Cycle Assessment (LCA) covering the life cycle of all cards.

So, there is a need for simplification. One option is to model cradle-to-grave LCAs by defining a limited number of case studies. Even if this could be achieved significant hurdles have to be taken of which the collection of representative data, for example, for card manufacturing, Integrated Circuit and magnetic stripe production can be the most challenging. In other words: for sheet production, card manufacturing and card distribution limited life cycle data are available today. Also modeling the final disposal is difficult, because there are no data available about the ratios between the different end of life options or about the specific end of life options themselves.

Another option is to consider only a part of the life cycle for which data are available today: i.e. card body raw material production. This data could be used to report on a part of the life cycle of the card up to and including the manufacturing of raw materials. Such a report covering only a part of a lifecycle is called an Eco Profile. Eco Profiles for many of the plastic materials used in the card industry are available and have been published, e.g. by Plastics-Europe, and are summarized later in this document.

For many of the materials that may be used in card production, Plastics Europe has reported Eco Profiles and has condensed the life cycle inventory data into "Environmental Product Declarations" (EPDs). The EPDs list a selection of input and output indicators considered most relevant by Plastics Europe. The inputs include non-renewable materials, renewable materials (biomass), water use, and non-renewable and renewable energy resources. The output parameters include global warming potential, ozone depleting potential, acidification and nutrification potentials, particulate matter and waste production. In an ideal world a LCA covers all indicators from the cradle to the grave but due to a lack of basic data two simplifications had to be provided for in this document:

1. a limitation of the number of indicators included in the data set, and
2. a limitation of the included card life cycle steps.

The ICMA Green Task Force has chosen to list Non-Renewable Primary Energy ("NRPE") consumption and global Warming Potential ("GWP") of a card to be, at this early stage, the most relevant to a card's Eco Profile. This data are readily available for a wide variety of materials, can be globally applied, relates to global concerns and are easily understood.

7.3. Eco Profiles of Card Materials, Cards, and Related Products

7.3.1. Principles

ICMA offers for card manufacturers, card personalizers and card issuers a simplified and standardized procedure to create an Eco Profile as outlined below. ICMA recommends the use of this approach if a full assessment in accordance with ISO 14040 is considered not justified, e.g. for economic reasons, or not possible, e.g. when only limited information is available.

7.3.2. Indicators

ICMA has selected the following key indicators to be reported as a result of the Eco Profile under this scheme.

7.3.2.1. NON RENEWABLE PRIMARY ENERGY (NRPE)

Many believe Global Climate Change is caused by the imbalance of greenhouse gases (GHG) in the environment; as more are emitted into the atmosphere than the planet is able to remove, resulting in the potential for climate change. The GWP (defined below) is sometimes also referred to as the "carbon footprint" and is measured by the net weight of carbon dioxide (CO_2) equivalents[4] being emitted. This is measured through a simplified Eco Profile.

GWP is measured over a certain period of time. This document uses the GWP measured over a period of 100 years. 100 year GWPs were adopted for used under the UNFCCC and Kyoto Protocol.

7.3.2.2. GLOBAL WARMING POTENTIAL (GWP)/"CARBON FOOTPRINT"/CLIMATE CHANGE

The concept of viewing the environmental impacts described above as a 'footprint' is a popular one. Its use in relation to climate change impacts through a 'carbon footprint' is currently quite widespread. It requires the use of an LCA study.

7.4. Methodology

To create an Eco Profile for a product under this scheme, the vendor shall define the following:

7.4.1. Part of Life Cycle Covered

Define the part of the card's lifecycle to be covered by the Eco Profile.

The part of the lifecycle covered by an Eco Profile always includes the raw materials, but may end anywhere between the raw material manufacturing and the final disposal of the product. Within the card industry, typical end points for a card Eco Profile are:

- Card Raw Materials (Resin)
- Card body (without e.g. integrated circuits or add-ons like hologram, signature panel etc.)
- Finished, unpersonalized card (with e.g. integrated circuit, hologram, signature panel etc.)
- Fully personalized card on carrier in envelope, ready for shipment to cardholder

7.4.2. Components and materials

Determine the components and materials the Eco Profile will cover. Clarify which components and materials are contained in the product but will not be covered by the Eco Profile. Give reasons for each component and material not covered, e.g. "negligible content" or "data not available."

Determine the contribution of each material and component to the indicators.

[4] CO_2 equivalents because other gasses such as methane also are emitted into the atmosphere and add to the greenhouse gas effect.

ICMA acknowledges that especially during the early phases of this scheme, the availability of an Eco Profile for all plastic materials might not be readily available to card manufacturers and personalizers.

To allow card manufacturers to prepare an Eco Profile in accordance with this scheme, without having to rely on their suppliers providing one about the supplied plastic material, ICMA provides data for the most commonly used plastic materials from cradle to pellet in Table 1 – Default Plastic Raw Material Indicator Values below. The data have been taken from existing, publicly available Eco Profiles.

While the Eco Profiles provided here might not be exactly representing the specific material used, they should in most cases allow a reasonably well-estimated basis for a card Eco Profile.

7.4.2.1. PLASTIC RAW MATERIAL CONTRIBUTION

Table 1 – Default Plastic Raw Material Indicator Values

Indicator	Unit	ABS[5]	APET[5]	HIPS[5]	PC[5]	PLA[6]	PP[5]	PVC[5]
NRPE	MJ/kg	95.01	80.29	87.14	112.54	42.19	72.95	55.45
GWP (100 year) [7]	kg CO_2eq/kg	3.74	3.23	3.40	7.60	1.30	1.94	1.88

ICMA recommends contacting material suppliers for Eco Profiles for materials not listed here.

7.4.2.2. RAW MATERIAL ECO PROFILE PER CARD

To calculate the NRPE and GWP indicators for a single card as given in Table 1, the values from 1 must be adjusted using the density of the card material as given in Table 2 – Plastic Raw Material Density Values and the card's volume, based on its average thickness, width and height. Table 2 – Plastic Raw Material Density Values provides average values for different materials. The actual value for a specific material and card construction may differ. Consult the supplier of the material for precise values.

Table 2 – Plastic Raw Material Density Values

Indicator	Unit	ABS	APET	HIPS	PC	PLA	PP	PVC
Density (d)	kg/l	0.95	1.33	1.07	1.40	1.25	1.07	1.33

With the material density d defined above, the value for a characteristic of a card (X_{card}) is calculated from the value per kg (X_{kg}) using the following formula, assuming the Card has the width w, the height h and the thickness t:
The indicator value per card, $X_{card}=X_{kg} * d * w * h * t /1\ 000\ 000$
Where:

- X_{kg} is the indicator value from Table 1, expressed with the unit
- d is the density of the material from Table 2 in kg/l, expressed without the unit
- w, h, and t are the average dimensions of the card in mm, expressed without the unit

[5] The data is taken from Environmental Product Declarations provided by Plastics Europe.
[6] The PLA data is provided by NatureWorks LLC and is only valid for Natureworks' Ingeo biopolymer (PLA) as produced by NatureWorks LLC per 2009.
[7] GWP (100years): Global warming potential measured over a period of 100 years.

Note: 1 l = 1 000 000 mm^3; hence if the dimensions are in mm and the density is in l, the resulting numerical value must be divided by 1 000 000.
Example: GWP of a 0.8 mm thick PVC card in ISO/IEC 7810 ID1 format:

- GWP of card material: 1.9 kg CO_2eq/kg
- Density of card material: 1.33 kg/l
- Average width: 85.60 mm
- Average height: 53.98 mm
- Average thickness: 0.8 mm

GWP_{card} = 1.9 kg CO_2eq * 1.33 * 85.6 * 53.98 * 0.8
= 1.9 * 1.33 * 85.6 * 53.98 * 0.8 / 1 000 000 kg CO_2eq
≅ 0.00934 **kg** CO_2eq
= 9.34 g CO_2eq

7.4.3. Contribution through transportation of components and raw materials

Determine the contribution of transportation of components and raw materials to the manufacturing site of the product.

Table 3 – Default Transport Indicator Values provides default values for NRPE and GWP for typical means of transport.

The values were originally taken from the GWP calculation system provided in 2009 by DEFRA UK, file "20090928 – guidelines-ghg-conversion-factors.xls"(available at the DEFRA UK website: http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm) tables 7e and 7f, and table 11.

These values were updated in 2015 by the U.K. government at its website:
http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/
A web tool with constantly updated conversion factors can be found at:
http://www.ukconversionfactorscarbonsmart.co.uk

Use the values from Table 3 unless different values have been established through a detail assessment of the transport chain.

Tables 3, 4 and 5 values should be updated yearly with values obtained from the U.K. web tool referenced above.

Table 3 – Default Transport Indicator Values

Type of transport	Energy consumption in MJ/tkm [8,9]	Total GHG CO_2eq in g/tkm [9]
Road (Truck)	1642	114 [10]
Train	380	26 [11]
Ship (Inland or ferry where goods remain on truck)	5569 [13]	387 [12]
Ship (Marine), e.g. container ship	158 [13]	11 [14]
Air (Short haul, < 462 km	79,960	5451 [15]
Air (Medium haul, > 462 km but < 1600 km	33,923	2313 [16]
Air (Long haul, > 1600 km	18,762	1279 [17]
Note: g/tkm is (CO_2 emission in g) per (ton of material transported) (over the distance of 1 km)		

If values from a detail assessment of the transport chain have been used, provide details of this assessment.

7.4.4. Contribution of the Manufacturing Process

Determine the contribution of the manufacturing process to the indicators for the product.
A reasonable estimate for the energy consumption per card is the sum of the energy consumed by the manufacturing facility over a time period divided by the number of cards produced in that time period.

Table 4 – Default Electricity Indicator Values provides default values for the NRPE used and the GWP created per kWh of electricity used.

Table 5 – Default GWP Values for Fossil Fuel Use and Table 6 – Default NRPE Values for Fossil Fuel Use provide default values for NRPE used and the GWP created per unit of fossil fuel.

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[8] Calculated from CO_2eq using DEFRA UK 2009, Annex 1
[9] The values are taken from the GWP calculation system provided by DEFRA UK at it's site: http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/
A web tool with constantly updated conversion factors can be found at:
http://www.ukconversionfactorscarbonsmart.co.uk
[10] Source: DEFRA UK 2015, "ALL HGVs, UK average"
[11] Source: DEFRA UK 2015, "Rail, Diesel"
[12] Source: DEFRA UK 2015, "Large RoPax Ferry"
[13] For the calculation of this value it was assumed the vessel uses Diesel as fuel
[14] Source: DEFRA UK 2015, Average of various types of bulk carrier and container vessels
[15] Source: DEFRA UK 2015, "UK Domestic Air Transport"
[16] Source: DEFRA UK 2015: "Short-haul international" from/to UK
[17] Source: DEFRA UK 2015: "Long-haul international"

The values in Table 4, Table 5 and Table 6 are taken from the GWP calculation system provided by DEFRA UK, http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/ A web tool with constantly updated conversion factors can be found at: http://www.ukconversionfactorscarbonsmart.co.uk

7.4.4.1. ELECTRICITY

Table 4 – Default Electricity Indicator Values

	NRPE[18]	GWP [19]
Region	**MJ/kWh**	**kg CO_2eq/kWh**
UK	9.2	0.462
Germany	12.0	0.472
France	6.7	0.059
Italy	9.3	0.399
USA	9.8	0.498
Russian Federation	12.7	0.450
Brazil	1.4	0.069
Canada	3.9	0.164
China	10.3	0.752
India	8.5	0.829
Japan	12.4	0.529
Australia	10.3	0.814

7.4.4.2. FOSSIL FUEL

Table 5 – Default GWP Values for Fossil Fuel Use

	GWP [19, 20]			
Fossil Fuel	**Kg CO_2eq/kWh**	**Kg CO_2eq/m³**	**Kg CO_2eq/t**	**Kg CO_2eq/l**
Natural Gas	0.18445	2.0332		
Oil/Diesel	0.25154		3189.9	2.67614
Coal	0.3285		2466.3	

[18] Values are taken from publications of Boustead Consulting, UK, 1999. Updated values

[19] The GWP values in Table 4 and Table 5 are taken from the GWP calculation system provided by DEFRA UK, http://www.defra.gov.uk/environment/economy/business-efficiency/reporting/ A web tool with constantly updated conversion factors can be found at: http://www.ukconversionfactorscarbonsmart.co.uk

[20] The GWP values in Table 6 are taken from the GWP calculation system provided by DEFRA UK, file "20090928 – guidelines-ghg-conversion-factors.xls", available at the DEFRA UK website: http://www.defra.gov.uk/environment/business/reporting/conversion-factors.htm. DEFRA Tables 1 and 11 were used here as a source.

Table 6 – Default NRPE Values for Fossil Fuel Use

	NRPE [20]			
Fossil Fuel	**kWh/MJ**	**MJ/m³**	**GJ/t**	**MJ/l**
Natural Gas	3.6	35.5	47.59	
Oil/Diesel	3.6		43.270	36.09
Coal	3.6		28.98	

7.4.5. Further Standardized Data for the Card Industry

As of the writing of this document, only card specific information covering the first step in the card's life cycle (plastic raw material production) is readily available to the authors and thus included in this report. The authors believe it would benefit the International Card Manufacturing Association if members who are involved in the manufacturing of sheet and cards collectively bring forth further data covering these subsequent steps. Furthermore individual card issuers or schemes may choose to complete life cycle case studies on their particular cards of interest using their particular supply chains.

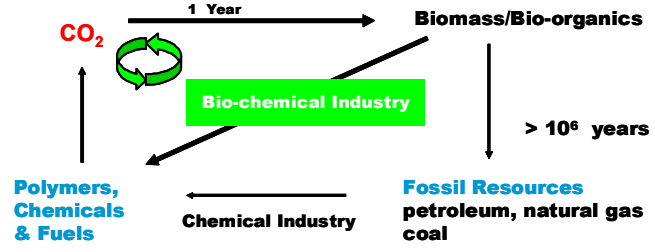
This document should therefore be considered as a starting point and when in the future more data are made available more phases of the cards life cycle can be covered by default values in this document in combination with using additional indicators.

8. BIO-BASED CARBON CONTENT

8.1. Introduction

During the growing season of plants, biogenic carbon dioxide is taken from the atmosphere and harnessed during the photosynthesis process and converted into sugars. These sugars can be stored in plants as sugars or starch or converted into other materials such as cellulose and lignin, altogether known as biomass. This process has occurred for hundreds of millions of years and during this time frame the fossil resources (coal, gas and oil) were formed. The carbon stored in these resources is called "old" or fossil carbon. Since the beginning of the twentieth century the chemical industry has been using these fossil carbon resources on a large scale to produce polymers, chemicals and fuels and as a result of that a significant part of this fossil carbon stored in the earth is released into the atmosphere via greenhouse gases predominantly based on this carbon leading to unsustainable changes better known as Global Climate Change.

In contrast to these fossil based raw materials which cannot be reproduced in a reasonable time and have finite availability, the bio-chemical industry uses raw materials which will be available as long as plants will grow thus leading to a sustainable raw material source. By definition, a



Source: R. Narayan

Figure 3. Biobased Carbon versus Fossil Carbon

sustainable material is one that meets our needs today without compromising the Earth's ability to meet those needs tomorrow. The biogenic carbon stored in the plants during the growing season is directly used to produce bioplastics and other raw materials. After use, the carbon can flow back to the atmosphere during incineration or composting or can be stored for a longer period of time during product use, landfill or recycling thus acting as a carbon sink. When carbon does flow back in to the atmosphere, plants are harnessing this new carbon into its biomass and so closing the short-cycle biogenic carbon dioxide loop. The carbon that is "recycled" is called "new" or biobased carbon. Both loops are illustrated in Figure 3, Biobased Carbon versus Fossil Carbon.

8.2. Measurement and Certification

As a result of the increased awareness of consumers to the need to purchase sustainable products, there is a growing market for products based on renewable raw materials. Several manufacturers are making synthetic materials using starch, cellulose or sugars creating a need for an independent, high-quality guarantee of the renewable carbon content in plastics. In order to make the distinction between the old or fossil carbon and the new or biobased carbon in plastics, ASTM developed the D6866 standard. Based on this standard the biobased carbon content in products can be certified by the Vincotte "OK biobased" and the US Biopreferred certification schemes. The analytical method behind these certifications is relatively simple and the exact value can be precisely and scientifically measured.

9. REDUCED MATERIAL (MASS)

Reduced material is defined as a reduction in the amount of material, energy or water used to produce or distribute a product or packaging or a specified associated component.

NOTE: For the purposes of this standard, a claim of reduced plastic needs not take into account the impact of personalization and other finishing processes that take place after card manufacturing. Due to the wide variety of secure and non-secure card applications and their associated personalization and finishing methods, it is not realistic at this time for this standard to require evaluation of personalized cards

9.1. Qualifications

9.1.1. When a claim of reduced plastic is made, the percentage of the reduction in plastic content shall be stated.

9.1.2. When a claim of reduced plastic is made, the basis for the comparison must be stated within the environmental claim. For instance, “This card contains 20% less plastic than a standard ID card”

9.1.3. If the reduction in plastic content is variable or estimated, it may be expressed with statements such as “at least X%” or “greater than X%.”

9.1.4. The use of an explanatory statement is optional, as long as the reduction in plastic content claim made is valid in all foreseeable circumstances with no qualifications.

9.2. Evaluation Methodology

9.2.1. Evaluation shall be undertaken in accordance with clause 6 of ISO 14021. In addition, the reduction in plastic content shall be expressed quantitatively as a percentage, calculated as shown below.

$$X(\%) = {}^{A}/_{P} \times (-100) + 100$$

Where

X is the reduction in plastic content, expressed as a percentage;
A is the mass of the unpersonalized card

P is the mass of an otherwise comparable ISO 7810 compliant ID-1 unpersonalized card of the same base material and of minimal dimensions in accordance with clause 5 of ISO/IEC 7810

9.2.2. Verification of the source and quantity of the materials may be carried out through the use of purchasing documentation and other available records.

10. RECYCLED CONTENT

Proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content, consistent with the following usage of terms.

Material recycling is only one of a number of waste-prevention strategies. The choice of a particular strategy will depend on circumstances and account should be taken of different regional impacts in making this choice. Consideration shall be given to the fact that a higher percentage of recycled content does not necessarily imply a lower environmental impact. Because of this, the recycled content claim, in particular, should be used with discretion. For the purposes of this standard, a claim of recycled plastic needs not take into account the impact of personalization and other finishing processes that take place after card manufacturing. Due to the wide variety of secure and non-secure card applications and their associated personalization and finishing methods, it is not realistic at this time for this standard to require evaluation of personalized cards.

10.1. Qualifications

10.1.1. When a claim of recycled content is made, the percentage of recycled material shall be stated. If the percentage recycled content is variable or estimated, it may be expressed with statements such as “at least X%” or “greater than X%”.

10.1.2. When a claim of recycled content is made, the resin may or may not be identified by name or abbreviation.

10.1.3. When a claim of recycled content is made, the recycled content shall be identified as “post-consumer,” “pre-consumer,” or “post-industrial.”

10.2. Use of a Symbol

10.2.1. When a claim of recycled content is made, the use of a symbol is optional.

10.2.2. If a symbol is used for a recycled content claim, it should be the Mobius loop accompanied by a percentage value stated as “X%”, where X is the recycled content expressed as a whole number calculated in accordance with 10.3.1 and 10.3.2. The percentage value shall be located either inside the Mobius loop or outside and immediately adjacent to the Mobius loop. Reference ISO14021 Section 7.8.3.5, Figure 2 for examples of acceptable locations of the percentage value. The Mobius loop with a percentage value, stated as “X%”, shall be taken to be a recycled content claim.

10.2.3. If the percentage recycled content is variable or estimated, it may be expressed with statements such as “at least X%” or “greater than X%”.

10.2.4. The use of an explanatory statement is optional, as long as the recycled content claim made is valid in all foreseeable circumstances with no qualifications. ”

10.3. Evaluation Methodology

10.3.1. Evaluation shall be undertaken in accordance with clause 6 of ISO 14021. In addition, recycled content shall be expressed quantitatively as a percentage, calculated as shown below. As there are no methods available for directly measuring recycled content in a product or packaging, the mass of material obtained from the recycling process, after accounting for losses and other diversions, shall be used.

$$X(\%) = {}^{A}/_{P} \times 100$$

Where

X is the recycled content, expressed as a percentage;

A is the mass of recycled material content

P is the mass of finished unpersonalized card.

10.3.2. An alternate acceptable method for establishing the percentage recycled content in a finished plastic card is to compare the mass of a plastic card, made of the specified recycled material and put through all card manufacturing processes without any added materials, with the mass of a plastic card made of the same recycled material with all relevant and necessary added materials.

$$X(\%) = ab/c \times 100$$

Where

x is the recycled content, expressed as a percentage;

a is the verified percentage of recycled content in the raw recycled material, expressed as a decimal

b is the mass of a plastic card made of the specified recycled material, without any added materials

c is the mass of a finished unpersonalized plastic card made of the specified recycled material with all relevant and necessary added materials.

Verification of the source and quantity of the recycled materials may be carried out through the use of purchasing, and other available, documentation.

11. COMPOSTABLE

The purpose of this specification is to establish standards for identifying and labeling plastic products and materials that will compost satisfactorily either in well-managed industrial composting facilities where the typical conditions of composting can be consistently obtained (i.e. a long thermophilic phase, aerobic conditions, sufficient water content, a suitable carbon/nitrogen ratio, etc.) or in home composting facilities which are more broadly available yet conditions of temperature and microbial activity are less controlled. Products meeting the requirements outlined in sections 11.1 are appropriate for labeling as “compostable in municipal and commercial facilities”. Products meeting the requirements of sections 11.2, may be labeled “home compostable”.

The test used simulates an intensive aerobic composting process. It measures

a) the ultimate level of aerobic biodegradation of the test material;
b) the degree of disintegration obtained;
c) any negative effects on the finished compost;
d) the maximum concentration of regulated metals in the compost.

The test is terminated when the plateau phase of the biodegradation has been attained; the standard time for termination is 45 days, but the test could continue for up to six months for industrial composting and twelve months for home composting.

NOTE: "compostable in municipal and commercial facilities", as defined in this standard, refers to composting conditions found in industrial composting facilities, generally not achievable with personal composting equipment. Further, industrial composting facilities are not available in all areas, which may preclude disposal of identified products at appropriate composting facilities. "Home compostable" as referred to in this standard, refers to composting practiced at ambient conditions under widely varying conditions of temperature, humidity and microbial activity.

11.1. Municipal Compostable

Municipal compostability shall be tested in accordance with ISO 17088.

11.2. Home Compostable

A plastic product is considered to have demonstrated a satisfactory rate and level of biodegradation in home composting if, when tested in accordance with ISO 14855, ISO 14851, ISO 14852 or ISO 17556 at controlled temperatures between 20°C and 30°C, 90% of the theoretical organic carbon content is biologically metabolized within 12 months or 90% of the value of a control sample of microcrystalline cellulose, metabolized within 12 months.

11.2.1. General test program

The tests are carried out according to the procedure described in standard EN13432:2000 adjusted as follows:

11.2.1.1. Organic matter content, limit on heavy metals and other hazardous substances: In accordance with EN13432.

11.2.1.2. Biodegradation: shall be tested at ambient temperature (between 20°C and 30°C), in accordance with one of the following standards: ISO 14855, ISO14851, ISO 14852 or ISO 17556. Pre-treatment using light or heat shall not be permitted. The test shall last no longer than 12 months. Biodegradation must be at least 90% of the theoretical organic carbon content or 90% of the value of a control sample of microcrystalline cellulose, metabolized within 12 months.

11.2.1.3. Disintegration: disintegration must be tested at temperatures between 20°C and 30°C. Disintegration must be determined in accordance with ISO 16929 adapted such that the temperature shall not rise above 30°C at any time and the test shall conclude in six months. After six months, 90% of the compost shall pass through a 2mm mesh screen, leaving no more than 10% by weight of the material being tested on the 2 mm mesh screen.

11.2.1.4. Compost quality: in accordance with EN13432.

11.2.1.5. IR analysis: an IR analysis is carried out for each component of the card, to identify the product.

11.2.2. **Test report: The test report shall provide all pertinent information, including*:***

11.2.2.1. All information necessary to identify and describe the product or material tested;

11.2.2.2. References to all standards, guidelines and regulations regarding the content of regulated metals and other toxic substances (a table of regulated metals and other toxic substances shall be presented, specifying each reference and stating the prescribed limit for each metal and other toxic substance, the concentration determined in the test and the percentage of the prescribed limit);

11.2.2.3. A description of other relevant requirements in the referenced documents and a statement, for each requirement, as to whether the test result was in conformity with the requirement or not.

Appendix A
(informative)
Bibliography

European Directive 94/62/EC on Packaging and Packaging Waste and its amendment European Directive 2004/12/EC

PCN 33-00019-19, Dec. 1996Final Report Examples of national or regional legislation of relevance to 6.4.1, ASTM Institute for Standards Research (ISR) Degradable Polymers Research Program

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