

Guidelines on “bio-attributed plastics” in the Eco Mark certification criteria

Eco Mark Office, Japan Environment Association

1. Background of development of the guidelines

Eco Mark Office developed the “Guidelines on plant-based plastics in the Eco Mark certification criteria” (the general guidelines) in 2015, introduced certification criteria for individual product categories on the content of bio-based plastics (PE, PET, PTT and PLA) that had been confirmed to be effective for reducing environmental impacts and has given certification to products that met the criteria.

Some plastics available particularly on the recent EU market are made from bio-based hydrocarbons (such as bio naphtha) that are blended with fossil-based materials in the manufacturing process. Similarly, in Japan, leading trading companies and petrochemical companies have been undertaking commercialization and manufacturing of those plastics around 2020 and this move is expected to expand in the future. This kind of plastics are managed under the mass balance approach that keeps track of the inputs of biomass feedstocks and the production outputs and attributed to the characteristics of the biomass feedstocks.

This kind of plastics are called “bio-attributed plastics” and have potential for promoting the government initiative of “Resource Circulation Strategy for Plastics” and expanding the use of renewable resources (biomass, etc.) significantly in a transition aiming to ensure that bio-based plastics assume a dominant position in newly developed plastics toward the achievement of carbon neutral society by 2050. Technologically, it is feasible to produce a wider variety of bio-attributed plastics than that of the existing bio-based plastics with biomass materials in the manufacturing processes.

In October 2020, Eco Mark Office received a proposal from business operators to create new product categories containing bio-attributed plastics and set up the “Working Group on revision of the guidelines on bio-based plastics in the Eco Mark certification criteria.” Separately from the general guidelines, Eco Mark Office developed the fundamental guidelines for introducing bio-attributed plastics as a new criteria item for individual product categories.

2. Principles on application of bio-attributed plastics to the Eco Mark certification criteria

The principles on the application of bio-attributed plastics to Eco Mark certification criteria in individual product categories and the criteria items are described below. The

guidelines also apply to bio-attributed synthetic fiber. In this case, the term “plastics” is read as “synthetic fiber.”

1) Product categories subject to the guidelines

The guidelines will apply to the Eco Mark product categories (certification criteria) that focus on the environmental characteristics of plastic materials at appropriate times in line with the fundamental policies such as the “Act on Promotion of Procurement of Eco-Friendly Goods and Services by the State and Other Entities (Act on Promoting Green Procurement).”

2) Criteria items

3. Terms and definitions

Biomass	Biomass is a term originally used in ecology to describe the amount (mass) of living organisms (bio). In this Guideline, it refers to resources that are organic matter-derived from plants and animals, excluding fossil fuels. (source: Roadmap for Bioplastics Introduction, January 2021 (Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forestry and Fisheries, Ministry of Education, Culture, Sports, Science and Technology))
Bio-attributed plastics	Plastics that are produced from organic compounds derived from biomass materials (hydrocarbons, fatty acid, alcohol, etc.) mixed with fossil-based materials in the manufacturing process and that are attributed to the biomass materials under the mass balance approach
Mass balance approach	A method in which, during the process of turning raw materials into final products and the distribution process (chain of custody), raw materials with certain properties (e.g., bio-based raw materials) are mixed with raw materials that do not have the properties (e.g., fossil-based raw materials); thus, the properties are assigned to a portion of the product according to the amount of input of the raw materials with those properties. (source: Roadmap for Bioplastics Introduction, January 2021 (Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forestry and Fisheries, Ministry of Education, Culture, Sports, Science and Technology))

4. Certification Criteria and Certification Procedures

4-1. Environmental criteria and evidence

4-1-1. Criteria for the attribution factor and traceability of biomass feedstock

- (1) The attribution factor of characteristics of biomass feedstock to plastic shall meet the criteria. The attribution factor shall be managed under the mass balance approach and maintained after a relevant product has obtained an Eco Mark certification.

** The attribution factor of characteristics of biomass feedstock will be defined by Criteria Development Committee and Criteria Review Committee for individual product categories in consideration of the criteria for bio-based content in products under the existing bio-based plastics certification schemes.*

Examples of Eco Mark product categories (certification criteria) subject to the discussion on the setting of attribution factor of characteristics of biomass feedstock

Product categories	
Plastic products (general)	
Stationery	
Household commodity	
Waste bags, films	
Fiber products	
Containers and packaging material	Molded products, etc.
	Laminated packaging material

[Certification Procedure]

An applicant shall submit a certificate that states the attribution factor of characteristics of biomass feedstock to plastic and supportive documents (product specifications, etc.).

Manufacturers and other relevant parties in the supply chain of the plastics shall calculate and record all inputs of biomass feedstocks attributed to the plastics and their production outputs and the attribution factors throughout a year (including supportive documents) to maintain the attribution factors of biomass feedstocks at an appropriate level. An applicant shall also submit any evidence documents of third-party audit or certification (an international sustainability certification for plastics, etc.) (submit an audit report, a copy of certificate, etc.). An applicant shall retain the evidence documents for five years.

4-1-2. Sustainability criteria for biomass supply chains

- (2) Sustainability of biomass mixed into plastic as raw material shall meet the requirements of Appendix 1 “Sustainability checklist of bio-attributed plastics (raw resin)” and the supply chains of the biomass shall be identified. If the biomass material has underwent third-party audit or certification for sustainability (an international sustainability certification for plastics, etc.), the result of audit or certification may be submitted as evidence instead of

Appendix 1.

[Certification Procedure]

An applicant shall submit documents on the source of biomass material (a cultivation area (country, state, city, etc.), a generation process of waste and residues, etc.), a manufacturing flowchart of plastic (describe the name of manufacturers of chemical raw materials, fundamental chemicals (monomers), polymers, etc.), and checklists or an evidence of international certificate.

4-1-3. Criteria for effects for reducing environmental impacts

- (3) It shall be confirmed through life cycle assessment (LCA) that the bio-attributed plastic does not cause an increase of GHG emissions (in terms of CO₂) throughout the product life cycle in comparison with fossil-based one to replace with.

[Certification Procedure]

An applicant shall submit the result of LCA conducted by a third-party. (An applicant shall provide the LCA result and the calculation conditions. If the applicant has undergone LCA under an international sustainability certification scheme for plastics, it may submit the data instead. The applicant may submit an academic paper published on a journal as an evidence as long as the same materials and/or manufacturing processes (sites) are mentioned in the paper as those used for the product applied for certification.)

4-1-4. Criteria for labeling on products containing bio-attributed plastics

- (4) Eco Mark shall be provided on products, packages, catalogues and the website in accordance with the “Environmental Labeling Guidelines” (Ministry of the Environment) and the following instructions:

- 1) Necessary information shall be provided on products, etc. to make the reason for Eco Mark certification known to consumers properly.

Example: “This product has a content of bio-attributed plastics of XX percent.”

[Examples of unacceptable claims]

Avoid phrases that may mislead consumers into believing that the product actually contains biomass material. :

- Phrases suggesting that the product contains biomass material, for example, “Use” and “Contain” biomass material
- The content of bio-based synthetic polymer XX%
- Bio-based content XX%

- 2) An applicant shall assure that it does not make a claim for the content of bio-based plastics in products that are not attributed to biomass characteristics in a single product category managed under the mass balance approach.

If a single product (or a molecular structure) is consisted of a material managed under the mass balance approach and other materials that actually contain bio-based plastics, the claims for those materials shall be made separately (not making a claim of them together).

*Example 1 Manufacturing a multilayer film consisting of a bio-attributed polystyrene film and a bio-based polyethylene film.

Example 2 Manufacturing PET by using bio-based ethylene glycol and bio-attributed terephthalic acid

[Certification Procedure]

An applicant shall submit a text, etc. of environmental claims. For the instruction 2), an applicant shall submit a statement of assurance.

September 1, 2022 Established

Appendix 1 “Sustainability checklist of bio-attributed plastics (raw resin)”

No	Purpose	Request (Item that must be realized)	Subject	Realized	Implementation Method (Check off all relevant items.)
1	Prevention of global warming, conservation of the natural ecosystem	Hasn't the farm land where plants are cultivated been converted from valuable land in biodiversity or land with high carbon storage (forests, peatland, etc.) since 2008?	Farm land	<input type="checkbox"/> Not converted <input type="checkbox"/> Converted <input type="checkbox"/> Not applicable due to residues or waste	<input type="checkbox"/> Confirmed the laws and regulations concerning the land conversion for the site. <input type="checkbox"/> Gained the understanding of the actual condition of the site through on-site investigation or hearings. <input type="checkbox"/> Defined and released the guideline for procurement of plants. Alternatively, conforming to the guideline of an independent third party. - Name of the guideline: - Location of release: <input type="checkbox"/> Also using the certification system of an independent third party, regarding the procurement of plants. -Name of certification system: <input type="checkbox"/> Others (Describe specifically.): []
2	Conservation of the ecosystem	If the Applicant uses the genetically modified crop as a raw material, has the Applicant assessed ensuring of safety?	Farm land	<input type="checkbox"/> Yes/ <input type="checkbox"/> No/ <input type="checkbox"/> Not applicable (GM crops Not used) <input type="checkbox"/> Not applicable due to residues or waste	<input type="checkbox"/> Confirmed the laws and regulations concerning genetically engineered crop on the site. <input type="checkbox"/> Gained the understanding of the actual condition of the site through on-site investigation or hearings. <input type="checkbox"/> Defined and released the guideline for procurement of plants. Alternatively, conforming to the guideline of an independent third party. - Name of the guideline: - Location of release: <input type="checkbox"/> Also using the certification system of an independent third party, regarding the procurement of plants. -Name of certification system: <input type="checkbox"/> Others (Describe specifically.): []
3	Prevention of land	Has the Applicant gained the understanding of usage conditions of	Farm land	<input type="checkbox"/> Yes/ <input type="checkbox"/> No	<input type="checkbox"/> Confirmed the laws and regulations concerning fertilizers/agricultural chemicals on the site

No	Purpose	Request (Item that must be realized)	Subject	Realized	Implementation Method (Check off all relevant items.)
	acidification/nutrient enrichment, water contamination	fertilizers/agricultural chemicals in the main cultivation area of plants? Isn't any agricultural chemical regulated under the "Stockholm Convention on Persistent Organic Pollutants" (POPs Treaty) used?		<input type="checkbox"/> Not applicable due to residues or waste	<input type="checkbox"/> Gained the understanding of the actual condition of the site through on-site investigation or hearings. <input type="checkbox"/> Defined and released the guideline for procurement of plants. Alternatively, conforming to the guideline of an independent third party. - Name of the guideline: - Location of release: <input type="checkbox"/> Also using the certification system of an independent third party, regarding the procurement of plants. -Name of certification system: <input type="checkbox"/> Others (Describe specifically.): []
4	Appropriate water usage	Has the Applicant gained the understanding of usage conditions of water in the main cultivation area of plants?	Farm land	<input type="checkbox"/> Yes/ <input type="checkbox"/> No <input type="checkbox"/> Not applicable due to residues or waste	<input type="checkbox"/> Confirmed the laws and regulations concerning usage of water (limits on the amount of water) on the site. <input type="checkbox"/> Gained the understanding of the actual condition of the site through on-site investigation or hearings. <input type="checkbox"/> Defined and released the guideline for procurement of plants. Alternatively, conforming to the guideline of an independent third party. - Name of the guideline: - Location of release: <input type="checkbox"/> Also using the certification system of an independent third party, regarding the procurement of plants. -Name of certification system: <input type="checkbox"/> Others (Describe specifically.) []
5	Use of recycled resources, avoidance of	If recycled resources are available as a part of crude raw materials of bio-attributed plastic (raw resin) on the site, did the Applicant preferentially	Raw resin	<input type="checkbox"/> Yes/ <input type="checkbox"/> No/ <input type="checkbox"/> Not applicable	Name of recycled resource in use [] Generated amount/percentage of recycled resources []

No	Purpose	Request (Item that must be realized)	Subject	Realized	Implementation Method (Check off all relevant items.)
	competition for food	use them?		(Not available)	
6	Prevention of global warming	Has the Applicant gained the understanding of the processing status of methane having a high global warming potential if it is generated by fermentation in the main manufacturing plant for the crude raw material?	Crude raw material manufacturing plant	<input type="checkbox"/> Yes/ <input type="checkbox"/> No <input type="checkbox"/> Not applicable	<input type="checkbox"/> Gained the understanding of the actual condition of the site through on-site investigation or hearings. <input type="checkbox"/> Others (Describe specifically.) []
7	Utilization of non-fossil energy sources and renewable energy sources	In the course of cultivation to raw resin manufacturing, did the Applicant utilize as many non-fossil energy sources (for example, bagasse, biogas, off gas, etc.) or renewable energy sources as possible?	Manufacturing plant	<input type="checkbox"/> Yes/ <input type="checkbox"/> No	Energy name and method of utilization []
8	Legal compliance	Does the manufacturing plant of the bio-attributed plastic (monomer, raw resin) follow related environmental laws and regulations and pollution control agreement with respect to air pollution, water contamination, noise, vibration, offensive odor, and emission of hazardous materials?	Resin manufacturing plant	<input type="checkbox"/> Yes/ <input type="checkbox"/> No	Monomer manufacturer / plant name [] Resin manufacturer / plant name []

* Residues or Waste defined in Renewable Energy Directive (RED) of EU

1. Definitions of terms

1) “Bio-based plastics”

The existing Eco Mark certification criteria for “plant-based” plastics are based on the assumption that plastics are made from “plant-based” materials such as sugar cane and corn. Recently, however, the term “plant-based” is unsuitable for some types of plastics containing animal-based fat that are emerging on the market. The “Roadmap for Bioplastics Introduction” jointly developed by Ministry of the Environment, Ministry of Economy, Trade and Industry, Ministry of Agriculture, Forestry and Fisheries, and Ministry of Education, Culture, Sports, Science and Technology uses the term “bio-based plastics” in the same vein as “plant-based plastics” and the term will be used in the Eco Mark certification process. The definitions of “biomass” and “bio-based plastics” used in the Eco Mark certification process were created based on the Roadmap. The term “biomass” is defined in ISO 14021:2016, 3.1.1 as “material of biological origin, excluding material embedded in geological formations or transformed to fossilised material and excluding peat” and the same definition is used in the Roadmap. The term “plant-based plastics” may also be used for plastic products made from plant-based materials (including those given an Eco Mark certification).

2) “Bio-attributed plastics”

In the context of the guidelines, bio-attributed plastics mean plastics produced from organic compounds derived from biomass materials (hydrocarbons, fatty acid, alcohol, etc.) mixed with fossil-based materials in the manufacturing process and attributed to the biomass materials under the mass balance (MB) approach that manages the inputs of biomass materials and production outputs. This type of plastics has no particular designation under Japanese and international laws and regulations, the Japanese Industrial Standards (JIS) and industry guidelines. The Working Group discussed whether the existing designation of “bio-based (plant-based) plastics” was suitable for use for this type of plastics.

In ISO 16620, an international standard for determining the amount of bio-based content in plastic products, the terms of “biobased synthetic polymer” and “biobased synthetic polymer content” are defined in Sections 3.1.4 and 3.1.5 respectively. They refer to the existing bio-based plastics (plastics added with biomass material). The paper “Mass balance approach to accelerate the use of renewable feedstocks in chemical processes¹” published by Plastics Europe in January 2020 states that the term “bio-based” shall refer to products from “Identity Preserved” or “Segregated” supply chains



¹ <https://plasticseurope.org/wp-content/uploads/2021/10/20100129-View-Paper-Mass-Balance-Approach-Renewable-Feedstocks.pdf>

and that must not be used for those from “Mass Balance” supply chains. In the paper, products from mass balance supply chains are referred to as “Renewable Attributed Products.” In addition, the glossary of the paper defines “Renewable Feedstock” as “Materials that have been produced from a source, usually plant or animal biomass, that can be renewed by short-to-medium-term regeneration as referred to in ISO 24699 section 3.1.1.” With this definition as a guide, some members of the Working Group suggested that the term “renewable feedstock” be used. To distinguish from plastics produced through chemical recycling of plastic waste, the Working Group decided to include “biomass” and “attribution” in the designation and avoided the use of “mass balance” and “credit” whose meaning may be difficult to understand for users and consumers.


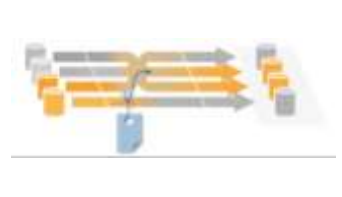
In the end, the Working Group decided to refer to this type of plastics as “bio-attributed plastics” in the Eco Mark certification system in consideration of the phrase of “bio-attributed PP, PE and other general-purpose plastics managed under the mass balance approach will come into widespread use ahead of bio-based ones” in the report of the 38th Central Environment Council, Subcommittee for Recycling Society, the Ministry of the Environment, Japan (on August 5, 2021).

3) “Mass balance approach”

The definition of mass balance approach under the guidelines was cited from the “Roadmap for Bioplastics Introduction” developed with some international standards as a guide. ISO 22095 “Chain of custody - General terminology and models” defines the mass balance model as the models “in which materials with a set of specified characteristics are mixed with materials without that set of characteristics in processing/distribution processes and the specified characteristics are attributed to a product in proportion to the input.” The whitepaper titled “Enabling a Circular Economy For Chemicals With the Mass Balance Approach” published by Ellen MacArthur Foundation suggests the four different Chain of Custody models in which processing/logistics supply chains from raw materials to products are supervised² (Note: The table below was created by Eco Mark Office with reference to the Whitepaper of Ellen MacArthur Foundation):

Model	Conceptual image	Description
Identity Preserved		Products originate from a single source and their specified characteristics are maintained throughout the supply chain. Example: Existing bio-based plastics, recycled plastics
Segregated		Materials from different sources may be mixed to produce products as far as those materials meet common criteria. The specified characteristics of materials are maintained from the start of input to the end of output. Example: Existing bio-based plastics, recycled plastics

² ISO 22095 suggests five Chain of Custody models including the “Controlled Blending” model that is positioned between “Segregation” and “Mass Balance” models.

Mass Balance		<p>Materials with a set of specified characteristics are mixed to produce products. The products are attributed to the specified characteristics of materials in the proportion to their input.</p> <p>Example: Forest certification, palm oil certification</p>
Book & Claim		<p>The supply flow of certified materials has no physical link with the supply flow of products. Products are attributed to the specified characteristics of materials through trading credits and certificates issued by independent agencies.</p> <p>Example: Green electricity certification</p> <p>This model does not apply to common bio-based plastics.</p>

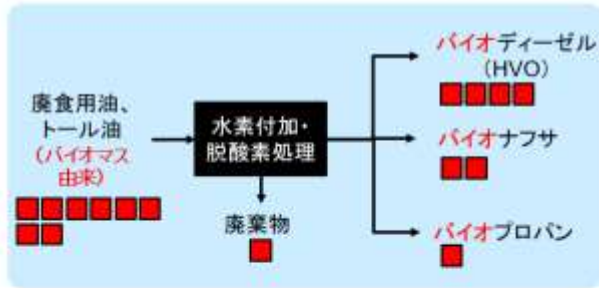
2. Background of development of the guidelines on bio-attributed plastics in the Eco Mark certification criteria

1) Manufacturing processes of bio-attributed plastics

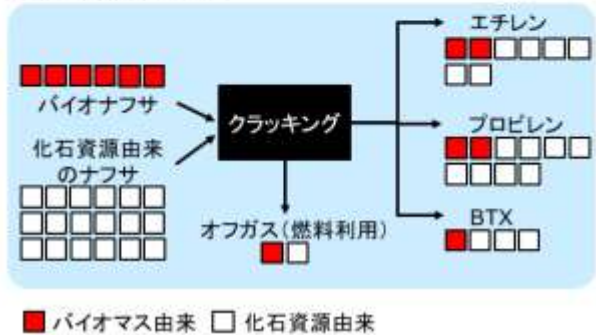
The figures below show general manufacturing processes of bio-attributed plastics under development toward commercialization. Biomass such as used cooking oil is hydrogenated and decarbonized into bio diesel and bio naphtha (hydrocarbons (mixture) with characteristics similar to naphtha produced from fossil-based materials (fossil naphtha)) (no attribution to biomass characteristics is made yet at this stage). In the next process, bio naphtha and fossil naphtha is charged into a cracking unit to produce fundamental chemicals such as ethylene and propylene. In this stage, the characteristics of biomass materials can be attributed to the plastics as shown in the right of the figure “2. Cracking process.” Then, those plastics are processed into finished products through “3. Polymerization” and “4. Forming” processes in which the products can be attributed to the biomass materials through the management of inputs and outputs.

Note) Eco Mark Office created the figures below to illustrate a relation between manufacturing processes and the attribution of characteristics of biomass materials to help the understanding of mass balance approach. Each business operator may have different manufacturing processes and attribution methods.

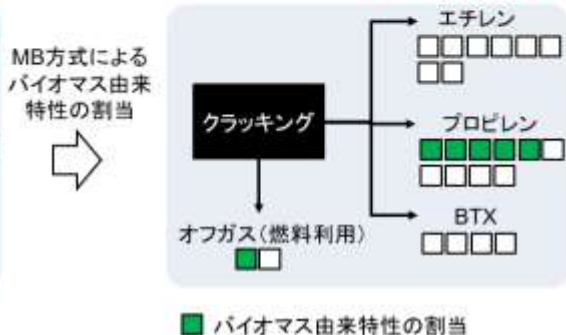
1. バイオナフサ製造工程 【実際の工程のイメージ】



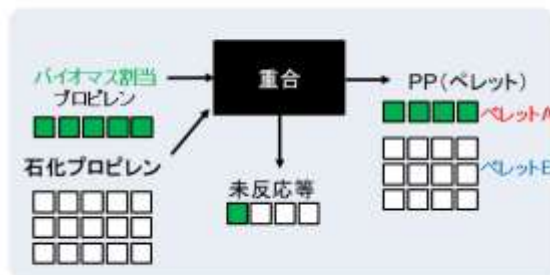
2. クラッキング工程



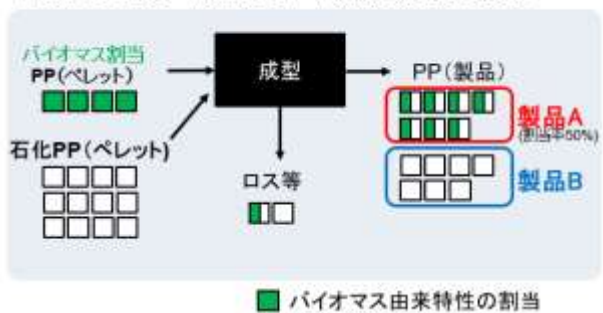
【割当のイメージ】



3. 重合工程



4. 成型工程(シート成型、ラミネート加工など)、最終製品



2) Background of development of the guidelines on bio-attributed plastics in the Eco Mark certification criteria

Bio-attributed plastics have potential for promoting the government initiative of “Resource Circulation Strategy for Plastics” and expanding the use of renewable resources (biomass, etc.) significantly in a transition aiming to ensure that bio-based plastics assume a dominant position in newly developed plastics toward the achievement of carbon neutral society by 2050.

The Eco Mark certification system has covered bio-based plastics (PE, PET, PLA and PTT). On the other hand, the guidelines cover plastics that are attributable to biomass materials used in the manufacturing process. Bio-attributed plastics and bio-based plastics are expected to be effective in reducing environmental impacts respectively. Theoretically, both can reduce the same level of environmental impacts on the global basis if they are produced through the same manufacturing processes.

Most bio-attributed plastics can be produced in the manufacturing processes of fossil-based plastics. This eliminates the need of large-scale capital investment and allows

production by any business operators that have necessary equipment. Technologically, it is feasible to produce a wider variety of bio-attributed plastics than that of the existing bio-based plastics. The concept of attribution (under the mass balance approach) is common in forest certification and palm oil certification, but still unfamiliar among consumers and business operators in Japan. Toward the widespread use of bio-attributed plastics in the Japanese market, it is important that the Eco Mark certification system covers bio-attributed plastics with defined certification criteria and that serves as a communication tool between business operators and consumers to promote correct recognition and understanding of bio-attributed plastics. The Eco Mark certification system covering both bio-attributed and bio-based plastics will facilitate technological innovation and advancement toward 2050 and help consumers accept a new concept of bio-attributed plastics.

3. Product categories subject to the guidelines

For bio-based plastics, Eco Mark certification criteria are defined for the product categories of plastic products (stationery/office supplies, household commodity, construction and civil engineering, furniture), containers and packaging material, and fiber products. Eco Mark Office will define criteria items of bio-attribute plastics for these product categories according to the guidelines. In addition, Eco Mark Office will newly define the criteria for bio-attributed plastics to the product categories in which no bio-based plastics have been available as a replacement for existing plastics with the aim of expanding the use and demand for biomass resources.

The Working Group discussed as to whether the criteria for bio-attributed plastics should be introduced to specified areas/applications in which the use of bio-attributed plastics is expected, but concluded that the criteria should be introduced to all product categories uniformly. For products subject to the Act on Promoting Green Procurement, however, the time of introducing bio-attributed plastics to the certification criteria should be decided in a manner consistent with the basic principles of the Act (the Eco Mark certification criteria are similar or stricter to/than the criteria of the Act in principle and can serve as a reference in procurement).

4. Basic principles of the guidelines

1) The relation with the “Guidelines on “bio-based plastics” in the Eco Mark certification criteria”

The Working Group discussed the details of the “Guidelines on bio-attributed plastics in the Eco Mark certification criteria” (the guidelines) based on the principles of the existing guidelines on bio-based plastics. To avoid confusion for business operators and companies due to different principles present in guidelines, the Working Group decided

to develop new guidelines (the guidelines) separately.

2) Types of plastics covered by the guidelines

The present Eco Mark certification criteria cover bio-based PE, PET, PLA and PTT that produced by fermentation and confirmed to be effective for reducing environmental impacts. It is difficult to produce bio-based PP and PA (nylon) used for food containers and packaging material and bio-based polycarbonate (PC) and ABS used for electronic devices.

Bio-attributed plastics covered by the guidelines are produced by the same manufacturing method (cracking, etc.) as fossil-based plastic. Therefore, it is possible to produce a wide variety of bio-attributed general-purpose plastics (PP, PE, PET, PVC and PS) and engineering plastics (PA, ABS, etc.). A report says that bio-based PP has a higher effects for reducing environmental impacts than fossil PP as bio-based PP is made from biomass such as used cooking oil and wood by-products through the same manufacturing processes as those of fossil PP after the biomass is turned into bio naphtha³. The “Roadmap for Bioplastics Introduction” mentions the mass balance approach and suggests the “introduction of bio-based plastics appropriate for individual categories of plastic products” without limitations of types of non-biodegradable bio-based plastics. In light of this, the guidelines do not limit the types of applicable bio-attributed plastics.

3) Biodegradability in the guidelines

Biodegradable plastics are subject to the certification criteria for Eco Mark product category No.141 “Biodegradable Plastic Products Version 1.” Bio-attributed plastics may be produced from biodegradable plastics, but biodegradability is not included in the criteria items under the guidelines.

4) Considerations in the application of the guidelines to individual product categories

The guidelines define criteria items common to all product categories including the attribution factor, traceability, sustainability, the effects for reducing environmental impacts, claims, etc. of bio-attributed plastics. The Eco Mark is operated as Type I environmental labeling program that assesses the environmental aspect of the whole product life cycle comprehensively. In this regard, some of Eco Mark certification criteria required to meet for individual product categories are not covered by the guidelines, including the restriction of use of hazardous substances, ease of degradability after use and ease of recycling. To apply the guidelines to define certification criteria for particular product categories, additional criteria items may be defined according to the characteristics of product categories considering the

³ <https://www.researchgate.net/publication/339484276> Environmental life cycle assessment of polypropylene made from used cooking oil

replacement for the existing fossil plastics used in the product categories (material properties, the use of additives, increase/decrease of plastic content, etc.), ease of degradability after use and ease of recycling.

5. Discussions on individual criteria items

4-1-1. Criteria for the attribution factor and traceability of biomass feedstock

(1) The attribution factor of characteristics of biomass feedstock to plastic shall meet the criteria. The attribution factor shall be managed under the mass balance approach and maintained after a relevant product has obtained an Eco Mark certification.

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1) How to assure that all biomass inputs are converted into (contained in) products (yield, etc.)?

In the discussion on the guidelines, there was a comment on the importance of establishing a scheme to confirm all biomass inputs are converted into (contained in)

products. If a biomass material has a chemical yield greatly different from a fossil-based one, it is inappropriate that a finished product is attributed to the characteristics of the biomass material under the mass balance approach with the same chemical yield as that of fossil-based one. Such an attribution of characteristics is undesirable in that it damages the confidence of consumers and the public in the mass balance approach and that prevents the widespread use of mass balance approach. Therefore, it is important to establish a scheme under which the Eco Mark plays a role of strengthening the confidence in the mass balance approach.

In the general manufacturing process of the plastics covered by the guidelines (PE, PP, etc.), used cooking oil, etc. is turned into bio naphtha through hydrogenation and decarbonization. Then, bio naphtha produced is mixed with fossil naphtha, subjected to cracking and processed into ethylene and propylene. After the mixing of bio and fossil naphtha, the mixture undergoes the same manufacturing processes as those for fossil-based plastics. There was a comment that scientific verification should be conducted to see if bio naphtha exhibits the same behavior as fossil naphtha in the cracking process. Some international certification schemes (such as ISCC⁴) for managing and assuring sustainability of biomass and renewable materials in manufacturing supply chains (including those under the mass balance approach) require calculation of attribution of biomass materials in consideration of their inputs and yields (calculated from the actual yields in the past three months) and production outputs.

Naphtha, a refined product charged into the cracking process is mixture with a boiling range of 30 °C to 180 °C, a similar range to gasoline. On the other hand, light naphtha, distillate from crude oil charged into a naphtha cracker for producing ethylene, has a boiling range of 35 °C to 80 °C. As an example of bio naphtha composition available to the public, UPM Biofuels “BIOVERNO NAPHTHA⁵” is described as mixture with a boiling range of 40 °C to 190 °C, “rich in saturated hydrocarbons with a carbon number range from C6 to C10” in the Safety Data Sheet. However, the published data is just an example of boiling range of bio naphtha. According to the discussion at the Working Group, there may be wide variations in a boiling range and the differences of distillation properties of naphtha should be assessed based on the comparison of distillation temperature. Raw materials for a naphtha cracker are required to meet strict specifications in procurement and those out-of-specifications are never accepted. Crude oil-based naphtha also has slight differences in properties depending on its sources and a boiling range for distillation and this may cause slight variations in production yields. This means that bio naphtha meeting the procurement specifications never causes an extreme loss of production yields and that the variations in production yields should

⁴ International Sustainability and Carbon Certification offers a certification system for managing and assuring the sustainability of biomass and renewable resources in global supply chains (ISCC PLUS program). <https://www.iscc-system.org/>

⁵ <https://www.upmbiofuels.com/siteassets/documents/upm-bioverno-naphtha-safety-datasheet-2022-en.pdf>

fall within a similar range to oil-based naphtha. Off-gas produced in the cracking process, such as methane and ethane, is used as fuel at plants and helps reduce CO₂ emissions as a whole.

From the discussions above, there seem to be no major differences in production yields between fossil-based and bio-based feedstocks as far as they are used in the cracking process. It was concluded that the criteria should be defined assuming that both types of feedstocks are converted into products at a similar yield. If any findings different from the present assumption are obtained from scientific verification on the bio naphtha behavior during cracking, the Working Group will discuss the revision of the criteria.

2) How to define the criteria for attribution factor

To define the standard attribution factor of biomass feedstock, it is not appropriate to treat bio-attributed plastics in the same manner as bio-based plastics in terms of the “effects for reducing environmental impacts” and the “superiority or inferiority in environmental values.” In the present Eco Mark certification system, the criteria for the content of recycled- and bio-based plastics is defined from the same perspectives. To ensure bio-based plastics will replace with as many fossil plastics as possible in the society, it is necessary to define the standard attribution factor of bio-attributed plastics from a strategic viewpoint considering technological limitations (the upper limit of content in products, ease of manufacturing, limitations of use) and cost/price limitations. In defining the standard attribution factor, considerations should also be given not to prevent the widespread use of bio-based plastics.

<Technological considerations>

(1) The upper limit of plastic content in products

In the Eco Mark certification system, the content criteria are defined for individual product categories considering general ingredients and their content in products. For example, laminated packaging material, in the category of containers and packaging material, is a multi-layered film consisted of multiple ingredients and bio-attributed plastics can be used easily for some layers and not for others for manufacturing reasons. The guidelines will define the upper limit of attribution of biomass material with reference to the content criteria for bio-based plastics.

(2) Ease of manufacturing and the limitations of use

Recycled plastics have more limitations than fossil-based plastics in durability, properties, safety and hygiene (the requirements by the Food Sanitation Act, etc.) and those limitations are considered in defining the content criteria for recycled plastics for Eco Mark certification. Bio-attributed plastics, on the other hand, are similar to fossil-

based plastics in properties and performance for use and have no particular limitations in processing and use depending on the difference in the attribution factor.

(3) Assumption of partial attribution of characteristics of biomass feedstocks

Taking bio-based PET (PET mixed with biomass in the manufacturing process) as an example, ethylene glycol, an ingredient accounting for 31% of the molecular structure is derived from biomass sources. For products assuming the use of polyester (PET) such as clothing, the criteria for the content of bio-based synthetic polymer are eased from those for general applications (molded products) of 25% or more to 10% or more. As can be seen from the example of bio-attributed PET, the partial attribution of biomass characteristics assumes that either of monomers of plastic are attributed to the characteristics. However, the plastic bottle industry is striving to offer 100-percent bio-based PET bottles, and therefore, the Eco Mark Office will not define the criteria for attribution factor to PET on the assumption of “partial attribution of biomass characteristics.”

<Costs and prices>

To define the criteria, considerations should be given to capital investment, raw material costs and manufacturing costs. For capital investment, bio-based plastics are produced with dedicated equipment. A certain amount of capital investment is needed to construct a plant even on a relatively small scale. Bio-attributed plastics, on the other hand, require new installation and/or renovation of equipment, but can be produced with that for fossil-based plastics after the cracking process. This saves capital investment and allows mass production.

According to a source, the price of bio-based PE is approximately three times as high as that of fossil-based PE⁶. The prices of bio-attributed PE, PP and other plastics are estimated to be two to three times as high as oil-based naphtha⁷ although no specific information is available. Bio naphtha is offered at a higher price than fossil naphtha. The prices of biomass feedstocks are passed onto products attributed to them, not to those with no content of biomass feedstocks. The price of bio naphtha varies in relation to that of bio diesel as bio naphtha is produced from used cooking oil as by-products of bio diesel. The price of bio diesel is influenced by the EU policies. The demand for bio diesel is expanding with the soaring crude oil prices and the global trend toward decarbonization. Accordingly, it is expected that the price of bio naphtha will not drop soon.

Some plastics such as PE are offered in the forms of bio-based and bio-attributed plastics. If business operators want to produce PE from biomass, they choose either of

⁶ http://www.env.go.jp/recycle/plastic/bio/pdf/bioplasicRoadmap_210329.pdf

⁷ [Bio naphtha speeds up the Japan's first attempt by Mitsui Chemicals to achieve a carbon neutral society and production of bio-based plastics - Japan Chemical News](#)

bio-based or bio-attributed form considering ease of manufacturing, ease of understanding for consumers and the difference in price between them. On the other hand, such bio-based PP actually using biomass materials is not available on the current market. Business operators which want to produce PP from biomass offer bio-attributed PP. At the discussion at the Working Group, there was a comment that bio-attributed plastics should be offered at reasonable prices toward wide acceptance in the society (business operators and consumers) and that the criteria that promote rapid expansion of use should be defined. Toward the achievement of carbon neutral society by 2050, plastic waste should be reprocessed into new plastic products to the extent possible (through material recycling or circular chemical recycling) and most of newly developed plastics should be derived from biomass sources. The mass balance approach serves as a production management method in a transition toward the achievement of carbon neutral society by 2050 and considerations should be given to facilitate development of bio-based plastics.

In the report of the 38th Central Environment Council, Subcommittee for Recycling Society, the Ministry of the Environment (on August 5, 2021), “(1) Basic principles on recycling waste plastics” described the outlook for “Further widespread use of bio-based plastics.” According to the outlook, “In 2050, after the innovation scenario is achieved, around 2.5 million tons of bio-based plastics will be used in the society (assuming 2.5 million tons of biomass sources will be used to produce plastics), and, in a transitional period toward the full-fledged introduction of bio-based plastics, bio-attributed PP, PE and other general-purpose plastics managed under the mass balance approach will come into widespread use ahead of bio-based plastics.” Eco Mark is expected to play a role in facilitating the move.

The attribution factor of characteristics of biomass feedstock will be defined by Criteria Development Committee and Criteria Review Committee for individual product categories in consideration of the criteria for bio-based content in products under the existing bio-based plastics certification schemes.

Examples of criteria for bio-based content in plastic products

Product categories		Eco Mark certification criteria for bio-based content in plastic products	Japan Organics Recycling Association Biomass Mark	Japan BioPlastics Association Biomass-based plastics	RSB Advanced Product	ISCC PLUS, REDcert ²
Plastic products (general) Stationery, household commodity Waste bags, films		25% or more	Bio-based content 10% or more	25% or more	Bio-based content or reduction of usage of fossil-based content: 25% or more	None defined
Fiber products		25% or more*				
Containers and packaging material	Molded products, etc.	25% or more				
	Laminated packaging material	10% or more				

*In the form of plant-based synthetic fiber

3) How to manage inputs and outputs of biomass feedstocks and attribute their characteristics to products properly

The key point of mass balance approach is to manage inputs of biomass feedstocks and production outputs (and yields) at every stage in a supply chain for a certain period and ensure that products are attributed to the characteristics of biomass feedstocks properly. This efforts build the confidence of consumers and society in the mass balance approach and products attributed to the characteristics of biomass feedstocks and promotes the widespread use of bio-attributed plastics. International sustainability certification scheme (ISCC, RSB⁸ and REDcert⁹) have basic principles of attribution under the mass balance approach as follows:

- The attribution amount is calculated based on the inputs, the outputs and the yield for a defined period.
- Attribution can be made to products within the same product group only.
- Only products that can be produced physically and chemically are attributed to biomass feedstocks used in production .
- Attribution is made within a single site in principle (a certification scheme may accommodate manufacturing at multiple sites by a single operator if those sites have obtained certification and manage the attribution amount).
- Attribution of the characteristics of biomass feedstocks cannot be made to products in duplicate.

If both bio-based and fossil-based materials are used in production, the loss of production has a bio-based content according to the input. Therefore, it is necessary under the guidelines to deduct a bio-based content in production loss in calculating the attribution of biomass feedstocks to products. If no attribution is made to production loss accordingly for the reason that the yield has declined substantially, more characteristics of biomass feedstocks are given to products than they are actually. Making proper attribution is important to facilitate the use of mass balance approach. The same holds true for off-gas reused for power generation. If a relevant product has obtained an international certification, the rule may apply instead. To maintain a certificate of any international sustainability certification scheme, certified companies are required to calculate and record inputs of biomass feedstocks, production outputs and the attribution amount of characteristics of biomass feedstocks in manufacturing processes at every stage throughout supply chains and undergo regular audits. Under the ISCC PLUS certification scheme, audit reports of certified companies are published on the ISCC website and certified companies are required to submit a Sustainable Declaration (SD) that describes the attribution amount, etc. for every business

⁸ The Round Table for Sustainable Biomass (RSB) runs a certification program with the aim of facilitating the widespread adoption of social and environmental requirements to ensure sustainable bio fuel production. <https://rsb.org/>

⁹ A kind of voluntary certification scheme run under the Renewable Energy Directive (RED), EU. REDcert² is a certification scheme for chemical products made from bio-based and recycled materials. <https://www.redcert.org/en/>

transaction.

In Japan, no management methods and no certification schemes under the mass balance approach have been established yet. No government guidelines and instructions have been available yet. On the other hand, ISCC PLUS and other international certification schemes are operated overseas. Under such a situation, it is premature for Eco Mark Office to develop its own certification scheme. At the discussion on the guidelines, the Working Group decided to use third-party audits and the existing international certification schemes in a transitional period until a consensus will be built on management under the mass balance approach in Japan.

It is desirable to adopt an Eco Mark-own certification system that matches with the business practice and supply chains unique to Japan and that offers credibility and rationality in a well-balanced manner. Eco Mark Office will continue to discuss the adoption of its own certification system in line with the future discussions in Japan and government guidelines.

A public comment was given to Eco Mark Office that the requirement for third-party certification should be eliminated after the processes in which the characteristics of biomass feedstocks are attributed to products. It is appropriate, for example, if relevant business operators (a brand owner, etc.) have agreed in writing that re-attribution will not be made after a forming process. At actual certification audits, however, the attribution method and acquisition of certification is assessed according to the rules of relevant certification schemes and the third-party auditors to which business operators submit their evidences. It should be noted that, in this context, relevant certification schemes are not limited to those listed for explanation in the guidelines.

ISCC and some certification schemes cover substances other than organic compounds such as ammonia. Accordingly, the guidelines define bio-attributed plastics as “plastics that are produced from organic compounds derived from biomass materials (hydrocarbons, fatty acid, alcohol, etc.) mixed with fossil-based materials in the manufacturing process and that are attributed to the biomass materials under the mass balance approach” (see “3. Terms and definitions”).

4-1-2. Sustainability criteria for biomass supply chains

- (2) Biomass mixed into plastic as raw material shall meet the requirements of Appendix 1 “Sustainability checklist of bio-attributed plastics (raw resin)” and the supply chains of the biomass shall be identified. If the biomass has undergone third-party audit or certification for sustainability (an international sustainability certification for plastics, etc.), the result of audit or certification may be submitted as evidence instead of Appendix 1

[Certification Procedure]

An applicant shall submit documents on the source of biomass material (a

producing area, a generation process of waste and by-products, etc.), a manufacturing flowchart of plastic (describe the name of manufacturers of chemical raw materials, fundamental chemicals (monomers), polymers, etc.), and checklists or an evidence of international certificate.

4) Sustainability of biomass materials

To facilitate the reduction of environmental impacts and build the social confidence in bio-based and bio-attributed plastics, it is essential that biomass materials are used in production in a sustainable and appropriate manner. To this end, it is important to keep track of biomass feedstocks throughout their life cycle (a producing area, a generation process of waste and by-products, etc.) and understand manufacturing processes of plastics.

For bio-based plastics, cultivation sustainability (particularly from an environmental perspective) and traceability of materials is checked by “Sustainability checklist of bio-based plastics” assuming the use of plant-based materials such as sugar cane and corn. Bio-attributed plastics, on the other hand, are made from a variety of materials such as used cooking oil, wood by-products (tall oil), food waste, waste wood and vegetable oil and all of those materials may not be covered by the above-mentioned checklist. The Working Group discussed the development of checklist for bio-attributed plastics in consideration of the types of biomass materials listed in the “Basic Plan for the Advancement of Use of Biomass (September 2016) ¹⁰” as shown in the table below:

Type of biomass		Annual amount of generation (*2)	The current usage rate	Target usage rate toward 2025
Waste	Livestock excreta	About 81 million tons	About 87%	About 90%
	Sewage sludge	About 78 million tons	About 63% (*3)	About 85%
	Black liquor	About 13 million tons	About 100%	About 100%
	Paper	About 27 million tons	About 81%	About 85%
	Food waste	About 17 million tons	About 24%	About 40%
	Residues from wood processing plants, etc.	About 6.4 million tons	About 97%	About 97%
	Wooden residues from construction sites	About 5 million tons	About 94%	About 95%
Unused material	Non-food agricultural products (except fertilizing materials)	About 13 million tons	About 32%	About 45%
	Logging residues	About 8 million tons	About 9%	About 30% or more

*1 The annual amount of generation and the usage rate are calculated based on statistics and data as of March 2016 (some data include estimated figures).

*2 The figures of black liquor, residues from wood processing plants and logging residues are calculated in dry weight. The figures of other biomass materials are calculated in wet weight.

*3 The usage rate of sewage sludge has declined after the occurrence of Great East Japan Earthquake.

¹⁰ <https://www.maff.go.jp/j/shokusan/biomass/attach/pdf/index-4.pdf>

For sustainability assessment, there are 16 voluntary schemes recognized by the EU Committee under the Renewable Energy Directive (RED) including ISCC, RSB and REDcert. In particular, the certification schemes (including the sustainability aspect) of ISCC PLUS, RSB Advanced Products and REDcert² cover plastic products and the acquisition of the certification by several Japanese companies has been reported to Eco Mark Office. For sustainability assessment items under these certification schemes, the International Trade Center (ITC) offers the “Standard Map¹¹,” a tool to compare various sustainability standards and “Blauer Engel (Blue Angel),” a Type I ecolabel program in Germany publishes a comparison report¹² on the website. According to the ITC’s comparison tool, ISCC PLUS, RSB Advanced Products and REDcert² have a wide range of similar sustainability standards broadly with minor differences in details. Under each scheme, biomass materials are assessed for sustainability mainly at the point of cultivation (residues, by-products and waste are assessed from the point of generation or collection in accordance with the RED). Under the guidelines, a certificate of any applicable international sustainability certification system proves the conformance with the Eco Mark certification checklist. The applicable international sustainability certification schemes include ISCC PLUS, RSB Advanced Products and REDcert² for example and are not limited based on the differences with each other. On the other hand, the checklist for bio-based plastics for Eco Mark certification was prepared bearing plants such as sugar cane and corn as materials in mind and does not include “protection of peatland,” a requirement by ISCC and other schemes. The Working Group decided to add “protection of peatland” to the checklist because bio-attributed plastics may contain vegetable oil as ingredients. The products that had obtained Eco Mark certification before the addition of “protection of peatland” are exempt from the application until the expiry date of the current certificate. The Working Group also decided that the principles of RED applied to the management of residues, by-products and waste and that regulatory compliance was assessed at the point of production of monomer and plastics respectively.

4-1-3. Criteria for effects for reducing environmental impacts

- (3) It shall be confirmed through life cycle assessment (LCA) that the bio-attributed plastic does not cause an increase of GHG emissions (in terms of CO₂) throughout the product life cycle in comparison with fossil-based one to replace with.

[Certification Procedure]

An applicant shall submit the result of LCA conducted by a third-party. (An applicant shall provide the LCA result and the calculation conditions. If the applicant has underwent LCA under an international sustainability

¹¹ <https://standardsmap.org/>

¹² https://www.umweltbundesamt.de/sites/default/files/medien/1410/publikationen/2019-08-19_texte_87-2019_be_biomassenutzung_uebergreifende-aspekte.pdf

certification scheme for plastics, it may submit the data instead. The applicant may submit an academic paper published on a journal as an evidence as long as the same materials and/or manufacturing processes (sites) are mentioned in the paper as those used for the product applied for certification.)

5) Effects of bio-attributed plastics for reducing environmental impacts

The “Guidelines on bio-based plastics in the Eco Mark certification criteria” apply to bio-based PE, PET, PLA and PTT, which were confirmed to have the effects for reducing environmental impacts from the results of typical life cycle assessment of each plastic. The guidelines on bio-based plastics require an applicant to submit the assessment result of the effects for reducing environmental impacts of relevant bio-based plastics in comparison with fossil-based plastics to replace with. The assessment of environmental effects throughout a product life cycle is described in the “Guidelines on plastic product design” (Public Notice No.1 by the Cabinet Office, Ministry of Finance, Ministry of Health, Labour and Welfare, Ministry of Agriculture, Forestry and Fisheries, Ministry of Economy, Trade and Industry, Ministry of Land, Infrastructure, Transport and Tourism on January 19, 2022) issued based on the “Act on Promotion of Resource Circulation for Plastics” with effect from April 2022.

“Guidelines on plastic product design”

(3) Product life cycle assessment

In plastic product design, it is important to assess environmental effects throughout a product life cycle from manufacturing to transport, logistics, sales, provision, use, disposal, recovery and disposal.

It is desirable to assess environmental impacts and other effects throughout a product life cycle in a comprehensive manner in terms of safety, functionality and other performance required for plastic products depending on their use and the requirements of (1) and (2) with a possible trade-off between these factors in mind. It is desirable to conduct product life cycle assessment in accordance with ISO 14040 (2006) or JIS Q 14040 (2010) and ISO 14044 (2006) or JIS Q 14044 (2010).

Note from Eco Mark Office: (1) and (2) mentioned in the above text describe <Structure> and <Material> of plastic products respectively.

3. Requirements to conform for design certification

(1) Comprehensive assessment and disclosure of information

As part of efforts to facilitate plastic recycling, business operators engaged in plastic product design shall assess environmental impacts and other effects throughout a product life cycle in a comprehensive manner on the items defined for individual product categories in consideration of application of those plastic products. Business operators shall disclose the assessment result and the principles on those recycling efforts that were decided rationally and voluntarily.

The guidelines apply to all types of bio-attributed plastics without limitations and require that any products applied for Eco Mark certification be effective for reducing environmental impacts throughout their life cycle in comparison to those made from fossil-based plastics to replace with. The Act on Promoting Green Procurement does not

cover bio-attributed plastics. The Act on Promoting Green Procurement covers bio-based plastics and requires that “products made from bio-based plastics be confirmed to be effective for reducing environmental impacts including trade-off throughout their life cycle by third-party LCA experts based on quantitative, objective and scientific analysis.” Accordingly, it is desirable under the guidelines that the effects for reducing environmental impacts are calculated in a reliable manner to the extent possible.

For bio-attributed plastics, a limited number of LCA results are published on academic journals. Some business operators disclose the effects of bio-attributed plastics for reducing environmental impacts on their website, but a detailed calculation method is not presented in some cases. At the discussion of the Working Group, there was a comment that the attribution of product to biomass characteristics is not enough as an evidence of reduction of CO₂ emissions in the LCA calculation. According to the comment, it is not enough, for example, to compare environmental impacts between bio-based and fossil-based materials prior to the point of charge into a naphtha cracker. It is necessary to compare environmental impacts between them “throughout a product life cycle,” up to the point of plastic production as required by the criteria specified in 4-1-3 (3). In this regard, to present the real effects for reducing environmental impacts, a decline in environmental impacts should be shown by any means, even if it is a small amount, through comparison of plastics production processes between using and not using bio naphtha without making attribution of biomass characteristics under the mass balance approach. Another issue pointed out in the discussion is the difficult of obtaining data by tracing back a long supply chain up to procurement of materials.

Some international sustainability certification schemes mentioned above require the verification of GHG emissions throughout a product life cycle (Cradle to Grave). The RSB has a certification requirement to reduce GHG emissions by 10 percent as compared with the existing fossil-based plastics. The Working Group decided that the RSB verification result can be used for Eco Mark certification if an applicant submit the “Certification Evaluation Report” and the conditions for calculating GHG emissions as an evidence. Under the ISCC and REDcert schemes, on the other hand, the calculation of GHG emissions is an optional requirement for certification (not mandatory). If an applicant chooses the option and undergoes verification according to the calculation rule, it may submit the verification result as an evidence to obtain Eco Mark certification (in this case, the applicant is required to submit the comparison with fossil-based plastics and the calculation conditions in the same manner as the submission of RSB verification result).

On the basis of these discussions, the guidelines require an applicant for Eco Mark certification to submit a result of product life cycle assessment conducted by a third-party in accordance with ISO 14040 “Environmental management - Life cycle assessment - Principles and framework” and ISO 14044 “Environmental management - Life cycle assessment – Requirements and guidelines.” Third-party assessment is

intended to enhance transparency and reliability of the result and include RSB verification results and joint studies and reviews with third-parties. An academic paper published on a journal may also be submitted instead of those evidences as long as the same materials and/or manufacturing processes (sites) are mentioned in the paper as those used for the product applied for certification. If the scenario from the point of production of bio-attributed plastic is the same as that for fossil-based one, an applicant may submit an LCA result up to the point.

Bio-attributed plastics currently available on the market are made from used cooking oil, wood by-products, etc. The EU Renewable Energy Directive (RED) classifies renewable sources into residues, waste, etc. In line with the classification of RED, the ISCC and other certification schemes require data “from the point of production” for residues and by-products (the amount generated at the point of cultivation is rated zero) and “the point of collection” for waste to conduct LCA, and the same applies to the checklist for Eco Mark certification for bio-attributed plastics. Calculation is required at every stage of product life cycle from cultivation and harvest of raw materials, disposal to recycling in principle. If bio-attributed plastics undergo the same processes as those of fossil-based plastics from the point of production of plastics, the calculation result from cultivation and harvest to production of plastics may be accepted.

The guidelines will be revised in line with national and international standards if any method to calculate the effects for reducing environmental impacts under the mass balance approach is presented.

<Reference> ISCC / RSB / REDcert standards for calculating GHG emissions

ISCC PLUS

ISCC PLUS Version 3.3: https://www.iscc-system.org/wp-content/uploads/2022/02/ISCC-PLUS_V3.3_20082021_final_JA_FIN_NEU2.pdf

ISCC EU 205 Greenhouse Gas Emissions: https://www.iscc-system.org/wp-content/uploads/2021/06/ISCC_EU_205_Greenhouse-Gas-Emissions-v4.0.pdf

ISCC PLUS 205-01 GHG Emission Requirements: https://www.iscc-system.org/wp-content/uploads/2017/02/ISCC_PLUS_205_01_GHG-Emission-Requirements.pdf

RSB Advanced Products

RSB Standard for Advanced Products(Non-energy use) (RSB-STD-02-001) Version 2.0: https://rsb.org/wp-content/uploads/2018/12/18-12-11_RSB-STD-02-001-v2.0-RSB-Standard-for-Advanced-Products.pdf

RSB GHG Calculation Methodology (RSB-STD-01-003-01) Version 2.3 : <https://rsb.org/wp-content/uploads/2020/06/RSB-STD-01-003-01-RSB-GHG-Calculation-Methodology-v2.3.pdf>

REDcert²

REDcert2 "Scheme principles for the certification of sustainable material flows in the chemical industry“ Version: RC² 1.1 :

https://www.redcert.org/images/SG_RC%C2%B2C_Sustainablematerialflows_Vers.1.1.pdf

REDcert EU Scheme principles for GHG calculation:

https://www.redcert.org/images/SP_EU_GHG_Vers.05.pdf

4-1-4. Criteria for labeling on products containing bio-attributed plastics

(4) Eco Mark shall be provided on products, packages, catalogues and the website in accordance with the “Environmental Labeling Guidelines” (Ministry of the Environment) and the following instructions:

1) Necessary information shall be provided on products, etc. to make the reason for Eco Mark certification known to consumers properly.

Example: “This product has a content of bio-attributed plastics of XX percent.”

[Examples of unacceptable claims]

Avoid phrases that may mislead consumers into believing that the product actually contains biomass material:

- Phrases suggesting that the product contains biomass material, for example, “Use” and “Contain” biomass material
- The content of bio-based synthetic polymer XX%
- Bio-based content XX%

2) An applicant shall assure that it does not make a claim for the content of bio-based plastics in products that are not attributed to biomass characteristics in a single product category managed under the mass balance approach.

If a single product (or a molecular structure) is consisted of a material managed under the mass balance approach and other materials that actually contain bio-based plastics, the claims for those materials shall be made separately (not making a claim of them together).

*Example 1 Manufacturing a multilayer film consisting of a bio-attributed polystyrene film and a bio-based polyethylene film.

Example 2 Manufacturing PET by using bio-based ethylene glycol and bio-attributed terephthalic acid

[Certification Procedure]

An applicant shall submit a text, etc. of environmental claims. For the instruction 2), an applicant shall submit a statement of assurance.

6) Environmental claims and provision of information for users and consumers

The Working Group discussed how to indicate the use of bio-attributed plastics in Eco Mark certified products (an environmental claim) on their packages, catalogues and the website. As of September 2022, no instructions and guidelines are provided by the government and relevant organizations on how to make an environmental claim for bio-attributed plastics under the mass balance approach. In the transition toward the widespread use of bio-attributed plastics in the Japanese market, there is a risk of greenwashing caused by labels misleading consumers in distinguishing between bio-attributed and bio-based plastics. To address this, it is important to provide correct information for consumers and help them understand and distinguish those types of plastics properly. To make an environmental claim for bio-attributed plastics in Japan, it is a precondition

to comply with the “Environmental Labeling Guidelines” required by the Ministry of the Environment. With reference to the papers published by Plastics Europe and international certification schemes such as ISCC, Eco Mark Office will define criteria items with which manufacturers must comply to provide users and consumers with correct information about the bio-content under the mass balance approach. A precise expression, for example, “This product contains plastics with XX percent of attribution of biomass characteristics” is acceptable. On the other hand, expressions suggesting that biomass materials were actually added to produce a product, for example, “This product contains/is comprised of/blended with biomass material” are prohibited by certification schemes and organizations that accept the mass balance approach, and therefore, those expressions are not accepted in the Eco Mark certification (see the ISCC’s rule on logos and claims shown below). The guidelines will be revised if the Japanese government and/or other organizations establish any guidelines on environmental claims under the mass balance approach.

If more biomass materials are charged at the cracking process in plastics production, carbon from biomass materials may be detected by 14C content measurement in products that are not attributed to biomass characteristics in a single product category managed under the mass balance approach. In this case, a claim of direct mixing of biomass materials into those products is prohibited because the attribution of bio-content has been made to other products (to prevent making the attribution of biomass characteristics in duplicate). If a single product (or a molecular structure) is consisted of bio-attributed material under the mass balance approach and bio-based material, such as a multilayer film and products partially attributed to biomass material, it is required to make claims for those materials separately (not making a claim of them together).

To gain widespread acceptance of the mass balance approach in the society, it is essential to provide correct and easy-to-understand information for business operators and consumers. In addition to claims on products, Eco Mark Office will make efforts to promote the understanding of mass balance approach in a correct manner in cooperation with the national government and relevant organizations.

ISCC’s rule on logos and claims under the mass balance approach¹³

Do’s ✓	Don’ts ✕
<p>Claim can refer to the effort to sourcing of sustainable raw material and must not refer to the physical characteristics of the product:</p> <ul style="list-style-type: none"> · “supports the production of” · “contributes to” · “product from certified sources on a mass balance basis / from mixed sources” · “investing in” 	<p>Cannot reference physical product characteristics directly, e.g. a claim regarding a bio-based content is not possible as this claim would suggest that the product contains bio-based material physically.</p> <p>This product</p> <ul style="list-style-type: none"> · is coming from a sustainable/responsible

¹³ https://www.iscc-system.org/wp-content/uploads/2017/02/ISCC_208_Logos-and-Claims_1.1.pdf

<ul style="list-style-type: none"> · “committing to” · “linked to” <p>Examples:</p> <ul style="list-style-type: none"> · ISCC compliant from mixed sources · Support of responsible production in line with ISCC requirements · Support of ISCC certified production · An equivalent amount of ISCC compliant material has been sourced · The required quantity of sustainable material is certified according to ISCC requirements · By buying ISCC certified (feedstock), (company) supports sustainable (feedstock) farming 	<p>source</p> <ul style="list-style-type: none"> · made from certified resources · based on renewable sources · 100% plant-based/bio-based · 100% renewable · completely based on renewable sources · contains
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