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Standard Practice for Assessing Relative Sustainability Involving Energy or Chemicals from Biomass¹

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1. Scope

1.1 This practice provides a methodology for assessing the relative sustainability of products, processes or projects involving energy and chemicals derived from biomass.

1.2 These assessments will facilitate informed decisions, leading to more sustainable outcomes.

1.3 This practice provides a methodology that includes setting goals and objectives, identifying the appropriate context and selecting appropriate indicators that ensure comparable, equivalent and replicable assessments of relative sustainability where at least one option is available from biomass.

1.4 The objectives of this practice are to reduce bias and distortion in the marketplace, facilitate fair comparison of options, focus on assessments reflecting stakeholder priorities, and support continual improvement for more sustainable outcomes.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*²

E1705 Terminology Relating to Biotechnology

E3050 Specification for Denatured Ethanol for Use as Cooking and Appliance Fuel

2.2 *ISO Standards:*³

ISO 14040 Environmental Management—Life Cycle Assessment -- Principles and framework

¹ This test method is under the jurisdiction of ASTM Committee E48 on Bioenergy and Industrial Chemicals from Biomass and is the direct responsibility of Subcommittee E48.80 on Sustainability of Bioenergy and Industrial Chemicals from Biomass.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

³ Available from International Organization for Standardization (ISO), ISO Central Secretariat, BIBC II, Chemin de Blandonnet 8, CP 401, 1214 Vernier, Geneva, Switzerland, <http://www.iso.org>.

ISO 14044 Life Cycle Assessment—Requirements and Guidelines

ISO 13065 Sustainability Criteria for Bioenergy

3. Terminology

3.1 For general terminology, refer to Terminology E1705.

NOTE 1—The user is advised that the definitions used by various industries, marketers, and regulatory bodies can differ from those specific to this standard. It is the responsibility of the user to ensure that the terms used in a particular context are clearly understood.

3.2 *Definitions:*

3.2.1 *biomass, n*—substance wholly comprised of living or recently living (nonfossil) material.

3.2.1.1 *Discussion*—Sometimes referred to as renewable organic material, examples of biomass include whole or parts of plants, trees, aquatic organisms, animals, algae and micro-organisms.

3.2.2 *continual improvement, n*—a systematic, iterative process of identifying and evaluating options and selecting those that provide incremental improvements toward achieving defined goals and objectives.

3.2.3 *indicator, n*—specific, science-based, observable and measurable characteristic.

3.2.4 *measure, v*—quantify the size, amount, or degree of something using a science-based approach and appropriate units.

3.2.4.1 *Discussion*—Science-based approach involves: measurement, objective observation, evidence, induction, repetition, critical analysis, and verification.

3.2.5 *science-based, adj*—scientific practices based on natural, social, or economic sciences that employ the scientific method.

3.2.5.1 *Discussion*—The scientific method is based on evidence and typically involves one or more of the following: objective observation, experiment, models, critical analysis, verification and testing, repetition, and induction.

3.2.6 *stakeholder, n*—individual, group, or organization that can affect or be directly affected by the product, process, or project under assessment.

3.2.6.1 *Discussion*—The selection of stakeholders depends

on the specific product, process or project and context. Stakeholders may vary over time and can include regulatory bodies, customers, neighbors, employees, suppliers, etc.

3.2.7 *sustainability, n*—Aspirational concept denoting the capacity to meet current needs while maintaining options for future generations to meet their needs. To make the concept of sustainability operational, consistent approaches are required that facilitate comparable, science-based assessments using measurable indicators of environmental, economic, and social processes (1); (2); (3)⁴

3.2.7.1 *Discussion*—Conceptual sustainability and sustainable development goals are described in the Brundtland Report (1987) and other legislation such as the National Environmental Policy Act (US Government 1969) which aimed “to create and maintain conditions under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic and other requirements of present and future generations.” Sustainability does not imply a steady state or an absolute value, but instead is a relative and comparative term that must have a defined context, based on clear objectives (4). No aspect of human activity can be “sustainable” everywhere or indefinitely without change or adaptation over time.

3.2.8 *relative sustainability, n*—a comparison of the sustainability of two or more options (products, processes or projects) to enable the understanding of the relative costs, benefits and trade-offs that are applicable to defined sustainability goals, objectives and indicators.

3.2.8.1 *Discussion*—An assessment of relative sustainability can be used to inform decisions leading to more sustainable outcomes.

3.2.8.2 *Discussion*—Assessing relative sustainability utilizes a scientific analysis of economic, social and environmental conditions to enable decisions that will improve the sustainability of a defined product, process or project.

4. Discussion of Concepts

4.1 It is important to clarify concepts used in this practice because they can be used differently in other sustainability certification standards and schemes.

4.2 Assessing Relative Sustainability

4.2.1 No aspect of human activity can be considered to be sustainable indefinitely. Environmental, economic, and social change preclude absolute sustainability without adaptation over time. Sustainability is a relative term and reflects choices among options, trade-offs across sustainability aspects (environmental, social, economic), selected criteria, and indicator values or trends in a defined place and time (context).

4.2.2 Comparison of relative sustainability typically involves some combination of past events and conditions as well as expectations about the future.

4.2.3 Because data about the past are limited and knowledge about the future is still more uncertain, a process to monitor indicators in a manner than can support continual improvement is a fundamental requirement for this practice.

4.3 Context and Stakeholders

4.3.1 The selection of context and stakeholders depends on the products, processes or projects to be assessed. Context establishes the appropriate temporal and spatial boundaries for the assessment. The context may include the places and time periods impacted.

4.3.2 The context will be used to identify stakeholder groups that can have an interest in the options to be assessed. Stakeholder input is important to help identify and prioritize goals and criteria for the assessment.

4.3.3 Determining the context for assessing the relative sustainability is a critical step. A decision or action that results in a more sustainable outcome under one set of conditions may not produce a more sustainable outcome under other conditions. The context and stakeholder priorities are important for selecting the specific indicators used in the evaluation of each option and for assessing the relative sustainability.

4.4 Continual Improvement

4.4.1 Given the definition of sustainability and the fact that social, economic, and environmental conditions are constantly changing, iterative analysis to support adjustments needed to assure progress toward defined goals is fundamental.

4.5 Continual Improvement in Sustainability Assessments

4.5.1 Because social, environmental and economic conditions are constantly changing, along with the information available to support indicator measurement and technological options, any effort to support more sustainable outcomes requires periodic monitoring and reanalysis. This standard practice requires the description of mechanisms that will advance the concept of continual improvement.

4.6 More Sustainable Outcomes

4.6.1 Recognizing that sustainability is not a state or end-goal, “more sustainable outcomes” underscores that an assessment process is limited to identifying what appears to be better at achieving specified goals within a defined context and based on the chosen criteria and indicators. One goal of this standard practice is to standardize a process for supporting informed decisions about the relative costs and benefits of options in terms of meeting both current needs and unforeseeable needs of future generations. Thus, more sustainable outcomes necessarily consider the value of conservation and reuse of non-renewable resources.

4.7 Science-based Indicators

4.7.1 The evaluation of options shall be based on indicators that are relevant, measurable and replicable.

4.7.2 This standard practice encourages the continued development of science-based indicators to address the priorities identified by stakeholders. Science-based indicators for some areas of concern are not yet adequately defined in standards.

4.7.3 See [Appendix X1](#) for examples of science-based measurable indicators.

4.8 Stakeholders

4.8.1 Engaging stakeholders can be challenging due to the breadth of potential interest groups and the physical, financial, and social-cultural barriers to constructive participation.

4.8.2 Sustainability aspects include global and regional issues such as climate, air, and water. Assessment processes

⁴ The boldface numbers in parentheses refer to a list of references at the end of this standard.

call for stakeholder involvement. The United Nations Sustainable Development Goals (2015) provide one example of such an effort and it is reasonable for projects to take such third party processes into consideration when seeking to identify broad stakeholder interests and priorities.

4.8.3 The ability to guide decisions to support more sustainable outcomes is compromised if an assessment relies on generalized data that do not capture priorities and trade-offs involved in a specific project and context. Information to guide decisions toward more sustainable outcomes is generated when assessments focus on a project scale appropriate to support data collection and analysis for the activities that are causally linked to locally defined problems and observable values. Stakeholder engagement is facilitated by focusing on a similar local scale.

4.8.4 Transparent communication is a prerequisite for constructive stakeholder engagement. Transparency supports the development of trust among parties and serves as a cornerstone for sustainability assessment and future monitoring and evaluation that are required for continual improvement.

4.8.5 A clearly defined project purpose, addressing a clearly articulated problem, will help establish boundaries that facilitate constructive stakeholder engagement.

4.8.6 Stakeholders contribute to defining priorities for criteria, indicators and assessment goals, considering trade-offs, identifying sources of information, and supporting ongoing work (monitoring) toward continual improvement.

5. Summary of Practice

5.1 Basic Principles for Assessing Relative Sustainability

5.1.1 Several basic principles are to be an integral part of an assessment plan. Following these principles improves the value and acceptance of the assessment outcomes.

5.1.2 *Transparency*—It is essential that the assessment be documented with sufficient detailed information such that the procedure and results are clearly communicated, understood, and can be reproduced by other parties.

5.1.2.1 The expectation of transparency does not stipulate that all information is made public. There may be situations where information could be considered confidential under standard business practices. Confidential business information is not included under the transparency principle.

5.1.3 *Stakeholder Engagement*—There are two aspects to stakeholder engagement. The first is to identify stakeholders that should be considered within the scope and context of the assessment. The second is the outreach to engage the identified stakeholders. As the assessment proceeds the stakeholder groups and engagement methods can be modified if needed to improve the input into the assessment plan.

5.1.4 *Timely Communication*—A system should be in place to share info on the status of priority indicators for energy or chemical options being assessed. Untimely reporting or delayed communication with stakeholders can hamper the effectiveness and value of the assessment.

5.1.5 *Equivalent Treatment*—The goal of a plan to assess relative sustainability is not to declare something as sustainable or not sustainable but to determine how options compare based on specific goals and objectives. These plans must be devel-

oped and conducted in a manner that avoids bias. Each option in the assessment plan shall be evaluated in an equivalent fashion.

5.2 *Six Steps for Assessing Relative Sustainability*—The six steps described below shall be followed when planning and conducting an assessment of relative sustainability. These assessments need to be planned and conducted incorporating specific principles to improve the acceptance of the assessment and prevent bias and market disruption.

5.2.1 *Step 1: Define the purpose of the assessment plan and the options to be assessed.*

5.2.1.1 The assessment plan shall clearly specify: who is initiating the plan as well as contact information for questions and general communication about the plan; the project timeline; primary purpose of the plan specified goals relevant to sustainability; and other aspects of the scope and project that are pertinent for subsequent steps, for example, references to background studies and impact assessments.

5.2.1.2 The assessment plan description can include other items described below related to context, stakeholders, alternative(s) available to achieve similar goals, etc.

5.2.1.3 The plan description can be modified based on stakeholder engagement and the discovery of new information as the assessment process proceeds. Such modification(s) shall be clearly documented and communicated.

5.2.1.4 The project definition should include the option(s) to be compared including the reference case option.

5.2.2 *Step 2: Document the scope of the assessment plan including goals, context, temporal and spatial boundaries and stakeholders.*

5.2.2.1 Clearly state the goals for the assessment plan including the objectives and timeline. Include special requirements and limitations to the assessment plan imposed by external factors, including time and budget.

5.2.2.2 The context description should include geographic areas and events associated with project activities; available data on current and historic conditions relevant to project objectives and activities; relevant regulatory requirements; sphere of influence and foreseen effects associated with the activities; and any documented stakeholder concerns and priorities.

5.2.2.3 Based on the project purpose, objectives and context, and the scope of the assessment, identify targeted stakeholders and provide them with access to timely information on the assessment plan and options to be assessed.

5.2.3 *Step 3: Review, select, prioritize, and apply indicators.*

5.2.3.1 Define selection criteria for indicators based on the assessment goals. Review resources available to support the assessment process.

5.2.3.2 Document the data sets, analyses, research and monitoring that are required to support science-based indicators relevant to the proposed assessment goals.

(1) **Appendix X1** provides references for several examples of science-based measurable indicators. Additional standards are expected to be developed to both improve existing science-based measurable indicators and support new indicators where none exist now.