

Strong Sustainability by Design

**PRIORITIZING ECOSYSTEM AND HUMAN FLOURISHING
WITH TECHNOLOGY-BASED SOLUTIONS**

INTRODUCTION



Strong Sustainability by Design

This Compendium has been created by committees of the IEEE Planet Positive 2030 Initiative supported by the IEEE Standards Association (IEEE SA). The IEEE Planet Positive 2030 Initiative community is composed of several hundred participants from six continents, who are thought leaders from academia, industry, civil society, policy and government in the related technical and humanistic disciplines. At least one hundred seventy members of this community from about thirty countries have contributed directly to this Compendium and have worked to identify and find consensus on timely issues.

The Compendium's purpose is to identify specific issues and recommendations regarding sustainability and climate change challenges to achieve "Planet Positivity" by 2030, defined as the process of [transforming society and infrastructure by 2030 to:](#)

- Reduce Greenhouse Gas (GHG) emissions to 50% of 2005 GHG emissions by 2030.
- Significantly increase regeneration and resilience of the Earth's ecosystems.
- Be well on the path to achieving net zero GHG emissions by 2050 and negative GHG emissions beyond 2050.
- Continue to widely deploy appropriate technology as well as design and implement new technological solutions in support of achieving technological solutions designed and deployed to achieve "Planet Positivity."

In identifying specific issues and pragmatic recommendations, the Compendium:

- Provides a scenario-based challenge (how to achieve "Planet Positivity by 2030") as a tool to inspire readers to get engaged.
- Advances a public discussion about how to build from a "Net Zero" mentality to a "Net or Planet Positive" ("do more good," that is, doing "more" than "don't harm") societal mandate for all technology and policy.
- Continues to build a diverse and inclusive community for the IEEE Planet Positive 2030 Initiative, prioritizing the voices of indigenous and marginalized members whose insights are acutely needed to help make technology and other solutions more valuable for all. Of keen interest is how to encourage more in-depth participatory design in these processes.
- Inspires the creation of technical solutions that can be developed into technical recommendations (for example IEEE SA recommended practice for addressing sustainability, environmental stewardship and climate change challenges in professional practice, [IEEE P7800™](#)) and associated certification programs.
- Facilitates the emergence of policies and recommendations that could potentially be intraoperative between different jurisdictions (e.g., countries).

By inviting the general public to read and utilize *Strong Sustainability by Design*, the IEEE Planet Positive 2030 community provides the opportunity to bring multiple voices from the related scientific and engineering communities together with the general public to identify and find broad consensus on technology to address pressing environmental and social issues and proposed recommendations regarding development, implementations and deployment of these technologies. You are invited to Join related IEEE activities, such as standards development and initiatives across the organization.

- For further information, learn more at the [IEEE Planet Positive 2030 Initiative website](#)
- Get in touch at: PlanetPositive2030@ieee.org to get connected to and engaged with the IEEE Planet Positive 2030 community.
- Please, [subscribe to the IEEE Planet Positive 2030 newsletter here](#).

If you're a journalist and would like to know more about the IEEE Planet Positive 2030 Initiative, please contact: Standards-pr@ieee.org.

Disclaimers

Strong Sustainability by Design is not a code of conduct or a professional code of ethics. Engineers and technologists have well-established codes, and the IEEE Planet Positive 2030 community respectfully recognizes the formative precedents surrounding issues of sustainability and the professional values these codes represent. These codes provide the broad framework for the more focused domain addressed in this Compendium, and it is hoped that the inclusive, consensus-building process around its design will contribute unique value to technologists and society as a whole.

This Compendium is also not a position, or policy statement, or formal report of IEEE or any other organization with which IEEE is affiliated. It is intended to be a working reference tool created through an inclusive process by those in the relevant scientific and engineering communities prioritizing sustainability considerations in their work.

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A Note Regarding Recommendations in This Document

Strong Sustainability by Design was created in two versions ("draft" and this current edition) that were iterated over the course of two years. The IEEE Planet Positive 2030 Initiative follows a specific consensus building process where members contributing content identify specific potential issues and proposed recommendations.

Membership

IEEE Planet Positive 2030, an initiative supported by the IEEE Standards Association as part of the Industry Connections Program, [Sustainable Infrastructures and Community Development program](#) (SICDP), currently has more than four hundred experts involved, and remains eager for new voices and perspectives to join in this work.

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Request for Input Draft (“Version One”) Published June 2023.
First Printing November 2024.
Printed in the United States of America.

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PDF: ISBN 979-8-8557-0935-3 STDVA27090
Print: ISBN 979-8-8557-0936-0 STDPT27090

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How to cite Strong Sustainability by Design:

The IEEE Planet Positive 2030 Initiative. *Strong Sustainability by Design: Prioritizing Ecosystem and Human Flourishing with Technology-Based Solutions*. IEEE, 2024. <https://sagroups.ieee.org/planetpositive2030/our-work/>

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STRONG SUSTAINABILITY BY DESIGN

PRIORITIZING ECOSYSTEM AND HUMAN FLOURISHING WITH TECHNOLOGY-BASED SOLUTIONS

Introduction

Imagine the future we¹ can build together.

This is the vision driving the work of **IEEE Planet Positive 2030**, an initiative created and supported by the IEEE Standards Association² that brings together a global, diverse, open community of experts to help chart a path for all people to achieve a flourishing future for 2030 and beyond.

The first step to imagine this future is to recognize the planet Earth and all its ecosystems and biodiversity form a part of all of us.³ The air we breathe, the water we drink, and the food earth provides comprise who we are. We cannot continue to treat planet Earth as a “resource” from which to be extracted—planet Earth is finite with finite resources.⁴ We should, instead, prioritize the health of our planetary biosphere and recognize that we humans are a part of the system, not above it or outside it.

In 1987, the United Nations Brundtland Commission defined “sustainability” as “meeting the needs of the present without compromising the ability of future generations to meet their own needs”.⁵ This implies “sustainability” is the long-term resilience of people and the planetary biosphere in unison. Achieving sustainability for millennia to come requires a shift from the zeitgeist of competition defining the Anthropocene⁶ era to a culture of care for the land and one another, a “culture of sustainability,” the ultimate goal/vision we can imagine, share, and achieve together.

A key intersection for sustainability involves technology and the context of how and when it is applied and/or used. Quoting *Herbert Simon (1916–2001), Nobel prize laureate 1978, A. M. Turing award 1975*:

“We must look ahead at today’s radical changes in technology, not just as forecasters but as actors charged with designing and bringing about a sustainable and acceptable world.”

¹ “We” refers to “all of us people”—our responsibility for “Now” and “Future Generations” of humanity and the earth’s biosphere.

² IEEE Planet Positive 2030 is part of [the Sustainable Infrastructures and Community Development Industry Connections program](#) of [IEEE SA](#).

³ “Us” refers to all people on Earth.

⁴ For instance, according to the 2024 [World Wildlife Fund’s 2024 Living Planet Report](#), there is “an average 73% decline in wildlife populations since 1970.” In other words, nature is dying.

⁵ See the definition of “sustainable development” on page 41 of [Our Common Future: Report of the World Commission on Environment and Development from the UN General Assembly, Development and International Economic Co-operation: Environment, A/42/427 \(annex\)](#), originally published 4 Aug. 1987.

⁶ From [Anthropocene](#) by Andrew Goudie: “Paul Crutzen and colleagues introduced the term ‘Anthropocene’ (e.g., [Crutzen 2002](#); [Steffen, et al. 2007](#)) as a name for a new epoch in Earth’s history—an epoch when human activities have ‘become so profound and pervasive that they rival, or exceed, the great forces of Nature in influencing the functioning of the Earth System.’”

New knowledge gives us power for change: for good or ill, for knowledge is neutral. The problems we face go well beyond technology: problems of living in harmony with nature, and most important, living in harmony with each other. Information technology, so closely tied to the properties of the human mind, can give us, if we ask the right questions, the special insights we need to advance these goals.”⁷

The IEEE Planet Positive 2030 process builds on IEEE experience considering the potential positive and negative impacts of the applications of technologies on people⁸ to also address impacts to our planet. It leverages previous work and vision created by IEEE taking an in-depth look at Artificial Intelligence, its applications and potential impacts as detailed in *Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems*:⁹

*“Ultimately, our goal should be **eudaimonia**, a practice elucidated by Aristotle that defines human well-being, both at the individual and collective level, as the highest virtue for a society. Translated roughly as ‘flourishing,’ the benefits of eudaimonia begin with conscious contemplation, where ethical considerations help us define how we wish to live.”¹⁰*

Human well-being has many facets: health, education, social networks among others. Fundamentally, it is dependent on planet Earth, its climate, and the health of the earth’s ecosystems. It requires that nature be honored so it can flourish in unison with all people and species, that we as individuals and organizations recognize and respect planetary boundaries, the role of and limits to natural capital. This leads to the concept of **Strong Sustainability**.

“Strong Sustainability” builds on the concept of “Sustainability” and stipulates that substitutability of natural capital and ecosystem services (by manufactured capital) be severely restricted to ensure availability of these resources for future generations, for human existence and well-being. The “consumption of natural capital is usually irreversible” (for example, loss of biodiversity).¹¹ Strong Sustainability provides boundary conditions for technological design and implementation based on the reality that earth’s ecosystems will function and evolve as they will despite any human economic or cultural imperatives.

Put simply: We need Nature. Nature doesn’t need us.

It is this recognition of our need to account for and honor earth that the title of our compendium is ***Strong Sustainability by Design: Prioritizing Ecosystem and Human Flourishing with Technology-Based Solutions***.

⁷ Salvatore T. March and Fred Niederman, “[The Future of the Information Systems Discipline: A Response to Walsham](#),” *Journal of Information Technology* 27, no. 2 (2012). Includes quote by Herbert A. Simon (2000).

⁸ Technology and Society,” IEEE Society on Social Implications of Technology (SSIT), <https://technologyandsociety.org>.

⁹ The IEEE Global Initiative on Ethics of Autonomous and Intelligent Systems, *Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems*, 1st ed. (IEEE, 2019).

¹⁰ In *Ethically Aligned Design: A Vision for Prioritizing Human Well-being with Autonomous and Intelligent Systems*, the first [three principles](#) are:

1. **Human Rights** – Artificial Intelligence Systems (AIS) shall be created and operated to respect, promote, and protect internationally recognized human rights.
2. **Well-being** – Artificial Intelligence Systems (AIS) creators shall adopt increased human well-being as a primary success criterion for development.
3. **Data Agency** – Artificial Intelligence Systems (AIS) creators shall empower individuals with the ability to access and securely share their data, to maintain people’s capacity to have control over their identity.

¹¹ Jérôme Pelenc, Jérôme Ballet, and Tom Dedeurwaerdere, “[Weak Sustainability versus Strong Sustainability](#),” brief for GSDR 2015.

Eudaimonia must embody conscious contemplation, “healing,” and conservation of our planetary biosphere, that is our natural world with a healthy atmosphere and ecosystems for all the living organisms it contains.

The name of the IEEE Planet Positive 2030 Initiative tells the story of how we¹² are approaching and doing our work:

- **Planet:** Our focus. The earth we must heal, protect, and sustain for humans and nature to flourish for seven generations¹³ and beyond.
- **Positive:** Our purpose. The design to give back more to the planet with technology than is removed and not to harm the biosphere/planet¹⁴.
- **2030:** Our urgency. The timeframe guiding our work inspiring responsible, bold, systems thinking to inspire accountable contextualized solutions, standards, policy, and pragmatic change.

Each chapter of *Strong Sustainability by Design* begins with a “IEEE Planet Positive vision of 2030” written as if the expert committee members authoring the content are in that future positive reality where the two “impossible goals”¹⁵ have been achieved. Discussions of “Issues” and “Recommendations” provide a pathway to get from today’s reality to the visions of 2030 as will be complemented by the feedback received as part of this process.

Many experts have collaborated, cooperated, and shared their insights to prepare this living document in an effort to not only imagine the future we can build but also identify potential technologies, standards, and solutions that can be implemented now to achieve “planet positivity” by 2030.

Now we call on you, on all interested people, to provide advice, input, and suggestions.

You are invited.

Imagine the future we can build together.

Your participation and insights will help build this future.

To achieve Planet Positivity for 2030 and beyond.

¹² We—the many contributors and participants of the Planet Positive 2030 Initiative.

¹³ For more information about the Seventh Generation Principle, see the 30 May 2020 blog post of the Indigenous Corporate Training, Inc., entitled “[What is the Seventh Generation Principle?](#)” When involving Indigenous communities, it is recommended to consider and prioritize the rights of Indigenous peoples, including the principle of free, prior, and informed consent. For more details, see: UN Human Rights, Office of the High Commissioner, “Free, Prior and Informed Consent of Indigenous Peoples,” from Sept. 2013.

¹⁴ Versus a “climate neutral” mindset.

¹⁵ Goal One: Transform society and infrastructure to achieve Planet Positive 2030 means reducing GreenHouse Gas (GHG) emissions to 50% of 2005 emissions by 2030 and significantly increasing regeneration and resilience of Earth’s ecosystems (as noted in the UN Convention on Biological Diversity’s [First Draft of the Post-2020 Global Biodiversity Framework from 5 July 2021](#), created as part of [COP 15 UN Biodiversity Conference](#)). Goal Two: Identify the current technological solutions that need to be deployed widely as well as technology gaps for which we need to design, innovate, and deploy new technological solutions to reach Planet Positive 2030.

RAISING THE WORLD'S STANDARDS FOR SUSTAINABLE STEWARDSHIP

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An initiative supported by the IEEE Standards Association
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