



Framework Proposal for Science-aligned Corporate Climate Action

June 2024

The scientific community agrees that to limit global warming to 1.5° C above pre-industrial levels with no or limited overshoot, the planet must reach a state of carbon neutrality by the middle of the century. Global carbon neutrality, as described by the IPCC, requires three complementary strategies: a deep and rapid reduction of greenhouse gas (GHG) emissions; a halt to deforestation and other ecosystem loss; and a rapid scale up of carbon dioxide removal to counterbalance residual GHG emissions. All three actions are necessary for a 1.5° C pathway. Achieving this transition will require strong and comprehensive incentives from policy makers as well as a significant scale up of corporate action.

Today, corporates face considerable challenges when identifying the most effective actions to: first reduce their emissions, second scale up carbon removal, and third communicate their progress. A lack of clarity in policies, standards and verification schemes has made it increasingly difficult for consumers and other stakeholders to differentiate companies that have applied high-integrity approaches from those that are greenwashing. This runs the risk of slowing corporate action and eroding consumer trust.

This paper provides a framework for science-aligned corporate climate action. The first priority is to reduce emissions in alignment with 1.5° C consistent scenarios across the entire value chain. As a secondary measure, we argue that high quality carbon removal credits are needed to balance residual emissions. The paper also discusses and analyzes the importance of frameworks and standards such as IC-VCMI, VCMI, and ISO 14068-1, strategies to augment quality assurance for reductions and carbon removal, and the use of third-party validation in assuring high integrity. The paper concludes that the best way to achieve high integrity, science-based credibility in climate claims on a product level includes deep product decarbonization, high quality carbon credits, and a corporate climate strategy, as well as transparent, detailed communication.

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Introduction

In 2018, the Intergovernmental Panel on Climate Change (IPCC) produced a report outlining the latest science on how to limit the planet's warming to under 1.5° C and, as a result, avoid the worst impacts of climate change.¹ Meeting this target will require both deeply decarbonizing industrial emissions over the next 30 years and significantly ramping up carbon removal to address the surplus carbon dioxide (CO₂) already emitted. The report outlines four scenarios for achieving this goal, ranging from steep decarbonization to a slower global decline in fossil fuel use ([Figure 1](#)).

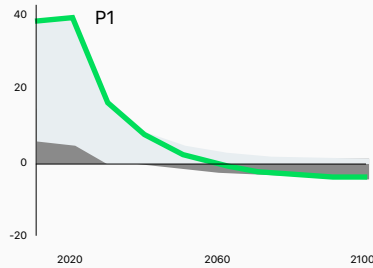
The science clearly shows that any successful strategy for addressing climate change must decarbonize energy and industry, protect and restore Earth's ecosystems, and develop carbon removal technologies — all pursued urgently, jointly, and in parallel.

Success will require the full and active participation of corporations, civil society, and governments. That said, a general lack of clear guidance can make it difficult for an individual company to translate the latest science into specific actions. The IPCC provides a framework of what is necessary at a global scale and some details of what should happen within particular industries. However, it does not prescribe actions down to the level of an individual nation or company. Various initiatives and frameworks, including the Science Based Targets Initiative (SBTi) and the Voluntary Carbon Market Integrity Initiative (VCMI), have been created to help fill this need for guidance. But individual companies still face uncertainty and conflicting advice about how much to contribute, over what timeframe, and how to communicate progress to stakeholders.

Though rules on climate claims will continue to evolve, there is generally broad agreement on the actions that corporations should take. In this paper, we will analyze the best practices that Apple has identified and is applying to our own strategy based on existing frameworks and standards, and the lessons we have learned by putting them into practice. We hope our work can be useful as a model for others on a similar journey.

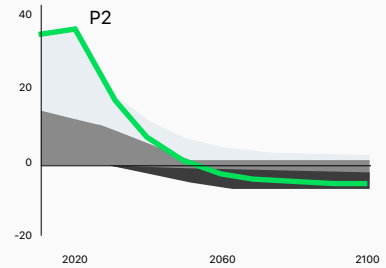
Figure 1: Four pathways to achieve 1.5° C of warming (Adapted from IPCC, 2018)

Billion tonnes CO₂ per year (GtCO₂/yr)



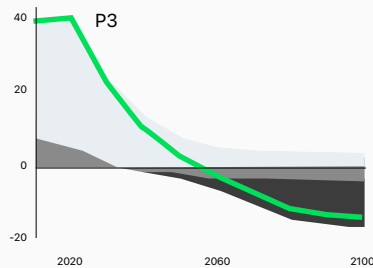
P1: A scenario in which social, business and technological innovations result in lower energy demand up to 2050 while living standards rise, especially in the global South. A downsized energy system enables rapid decarbonization of energy supply. Afforestation is the only CDR option considered; neither fossil fuels with CCS nor BECCS are used.

Billion tonnes CO₂ per year (GtCO₂/yr)



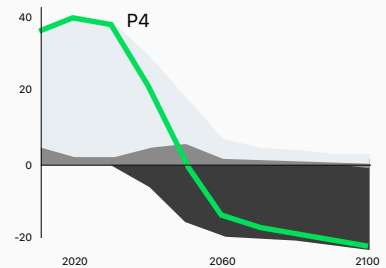
P2: A scenario with a broad focus on sustainability including energy intensity, human development, economic convergence and international cooperation, as well as shifts towards sustainable and healthy consumption patterns, low-carbon technology innovation, and well-managed land systems with limited societal acceptability for BECCS.

Billion tonnes CO₂ per year (GtCO₂/yr)



P3: A middle-of-the-road scenario in which societal as well as technological development follows historical patterns. Emissions reductions are mainly achieved by changing the way in which energy and products are produced, and to a lesser degree by reductions in demand.

Billion tonnes CO₂ per year (GtCO₂/yr)



P4: A resource- and energy-intensive scenario in which economic growth and globalization lead to widespread adoption of greenhouse-gas-intensive lifestyles, including high demand for transportation fuels and livestock products. Emissions reductions are mainly achieved through technological means, making strong use of CDR through the deployment of BECCS.

- Fossil fuel industry
- Agriculture, Forestry and Other Land Use (AFOLU)
- Bioenergy with carbon capture and storage (BECCS)
- Global net CO₂ emissions

Credible Action — What a Company Should Do

To be credible, we believe that corporate climate action needs to be meaningful, rapid, and based on science. This means a company should:

- Quantify its emissions footprint across scopes 1, 2, and 3 using an internationally recognized standard
- Set time-bound targets inclusive of all scopes, emphasizing near-term action to reduce gross emissions in line with a 1.5° C pathway based on science
- Reduce gross emissions in line with a 1.5° C pathway based on science
- Scale up carbon removals globally, outside of its footprint
- Obtain third-party verification of the above
- Communicate progress in a transparent manner

Quantify the footprint, including all scopes, using an internationally recognized standard

Credible climate action requires an assessment of one's total footprint — scopes 1, 2, and 3. It is possible to take meaningful action on climate without first quantifying the total footprint, such as purchasing renewable energy or installing energy-efficient lighting and equipment, and companies should not wait for complete information before taking obvious actions. But only by measuring carbon emissions are companies able to fully understand their footprint, develop strategies, and identify opportunities to reduce emissions and, ultimately, achieve decarbonization.

The recognized best practice for calculating a carbon footprint is to follow internationally recognized standards, such as those issued by the GHG Protocol (Corporate Standard and Corporate Value Chain Standard for organizational footprints, Product Life Cycle Standard for product footprints) or ISO (14064-1 for organizations, 14067 for products). Emissions from the entire value chain should be included, including scope 3 emissions from supply chain partners and the use of products by customers. Scope 3 emissions are challenging to quantify, but companies can model them with a sufficient degree of accuracy to take meaningful action across their value chain. For many companies, scope 3 represents the majority of the emissions attributable to their business. As such, it is critical that they be included in any credible corporate climate strategy.

In particular, electronics manufacturers need to pay attention to the complexity involved in modeling upstream emissions of their products. To identify the top component contributors to Apple's carbon emissions, we use a life cycle assessment (LCA) methodology in accordance with ISO 14040, ISO 14044, and ISO 14067 standards. We begin with a quantified bill of materials and process knowledge of the materials and activities required to manufacture a product, and then model major refining, processing, assembly, and testing steps down the line. Critical parameters may be mass, recycled content, process time, or even area and technology node, such as in semiconductor manufacturing. We combine these elements with other industry average data or assumptions to build a comprehensive footprint of a product.

It may be appropriate for some manufacturers to take a simpler approach, using an economic input/output model that scales a general emissions factor by the value of the goods purchased. The best approach depends on the number of products to assess, the sensitivity of the overall footprint to each product's emissions, and its applicability to a company's goals and public targets. For example, a simplified model could be useful for companies just beginning to identify emissions hot spots among hundreds of products. However, a simple model may make it more difficult to recognize the positive impact of interventions if they aren't reflected in it. Companies in the electronics industry can leverage tools such as the Product Attributes to Impact Algorithm (PAIA)², and there may be additional guidance on LCAs in product category rules.³

Set targets

Setting public commitments and quantified targets is useful for guiding internal roadmaps, helping incentivize collective action among peers, and establishing a mechanism of near- and long-term accountability that ideally persists as individuals and leadership rotate and transition in and out of a company over the years.

While the IPCC sets out what is necessary globally, frameworks like SBTi help translate those goals to the level of an individual company. SBTi outlines two types of targets:

- Near-term, where a company commits to reduce scope 1 and 2 GHG emissions (and scope 3, if more than 40 percent of the total across all scopes) by a certain percentage per year (on average) 5–10 years in the future. The percentage required depends on the company's sector and whether the company aims for a pathway of 2° C or 1.5° C.
- Net-Zero, where a company commits to reduce GHG emissions (all scopes) by 90 percent no later than 2050, with the remainder counterbalanced by carbon removal credits. This largely aligns with the level of decarbonization that the IPCC says must happen globally. Companies must also have near-term targets to avoid delaying climate action to later decades.

Additionally, the recently published standard ISO 14068-1 “Climate change management — Transition to net zero — Part 1: Carbon neutrality” similarly calls for companies to set reduction targets aligned with a 1.5° C pathway and describes a few types of target year dates that broadly align with the IPCC global pathways.

In all cases, companies must be thoughtful and deliberate about their commitments. Targets need to be informed by their emissions inventory and supported with a plan and sufficient resources to carry out the transition.

In 2020, Apple committed to reducing emissions across all three scopes by 75 percent compared with 2015 and balancing the residual emissions with high-quality carbon removal by 2030. We are also committed to working toward reaching a 90 percent reduction in emissions from our 2015 baseline by 2050. Attaining this deep 90 percent decarbonization target will require a different focus and a collective, global effort. Entire industries and economies must decarbonize. And while reaching a 90 percent reduction in emissions is outside Apple’s or any one company’s control, Apple is committed to supporting action as part of this global shift: to push for better policies, invest in new technological innovations, and engage in new and expanded partnerships, both public and private.

Take action inside the value chain to reduce emissions

The next step is to plan out and execute actions to reduce emissions. Most companies will prioritize reductions in scope 1 and 2 emissions first, as they’re more directly in their control and easier to measure. However, companies should not ignore opportunities to drive reductions in scope 3 emissions in parallel, especially if they have significant scope 3 footprints. They must prioritize reductions before compensating for emissions with actions outside the value chain, such as carbon credit offsetting.

Apple has been carbon neutral for our global corporate operations since 2020, in large part because we maintain our commitment to power 100 percent of our operations worldwide with 100 percent renewable electricity, which we achieved in 2018. Apple’s goal is to reduce our gross emissions by 75 percent, across all scopes, compared with 2015 levels by the end of the decade and balance residual emissions with high-quality carbon removal credits. We are unequivocal in our priority: Emissions reductions take precedence over carbon removal.

It should be noted that the relevant GHG Protocol and ISO standards are now nearly a decade old and do not capture all the realities of today’s economies. It is expected that future revisions will, among other items, provide more detailed guidance on how to use market instruments like renewable energy certificates or sustainable aviation fuels to address scope 3 emissions. In the meantime, the best practice is to use the core principles of each standard to fill any gaps on a best-effort, good-faith basis.

Companies should use the emissions inventory they have built to identify concentrations of emissions. These likely represent the most significant opportunities for reductions. For example, in 2015, the emissions associated with aluminum for enclosures represented a substantial part of Apple's footprint. This resulted in several initiatives to address the impact, including shifts to low-carbon electricity for smelting, a more concerted move to developing recycled alloys, and investments in new processes, such as inert anode. These efforts have significantly benefited our footprint and contributed to bringing aluminum down from 27 percent of our total footprint in fiscal year 2015 to less than 8 percent in fiscal year 2022.

While not strictly required by external frameworks, we believe the following principles are critical for companies to follow:

- Prioritize efficiency improvements, in both energy and materials usage, across all scopes.
- Electrify as many processes as possible, across all scopes.
- Switch all electricity sourcing to renewables, including all estimated scope 3 electricity. Carbon credits are not an appropriate solution for electricity-based emissions, and they should be reserved only for unavoidable non-electricity emissions.
- Use the footprint data to find opportunities to make low-carbon choices — for example, through intentional product design decisions that choose lower-carbon materials or in logistics by choosing lower-carbon modes of transportation.
- For any remaining non-electricity-based emissions, investigate additional technological innovations specific to those sectors, such as low-emission processes or transportation modes.

Following these principles, companies should prioritize achieving reductions as fast as possible, and at a minimum should aim to meet or exceed an established, science-based pathway. The International Energy Agency (IEA) and SBTi are two potential references for such general pathways and have also issued industry-specific sectoral decarbonization pathways that companies should follow where relevant. Barring any other guidance, a company may take the IPCC global pathways and apply them directly, until better guidance is available. All such pathways must be viewed as minimums, and companies that can achieve reductions more quickly should. Our Apple 2030 goal, to reduce emissions by 75 percent from 2015, is based on how much we believe is possible by the end of the decade and goes beyond current available guidance.

Companies in the electronics sector, in particular, may also consider partnering with leading research programs, such as imec, to identify additional carbon reduction development opportunities that apply to the entire sector. Data centers and transmission represent another common emissions source unique to the industry. Companies should prioritize efficiency improvements wherever possible. For the remaining electricity load, they should prioritize sourcing renewable electricity.

Scale up carbon removals globally, outside one's footprint

The IPCC reports are clear: To avoid the worst effects of climate change, simply reducing emissions will not be enough at this point. We need to remove emissions already in the atmosphere, alongside emission reductions. We also need to halt deforestation and other net land-use change emissions urgently — before the end of the decade. There remains insufficient government policy in place to support these activities at a global scale. It falls to voluntary actions by corporations to invest in these projects today for a chance to hit 1.5° C.

The voluntary carbon market uses carbon credits to track each project's climate impact. The market requires that the impacts those credits represent are real, additional, measurable, not double counted, and permanent. There is debate on whether particular types of carbon projects are “permanent” or not. While some would argue that only technological solutions can be considered permanent, it's important to note that permanence can be demonstrated in multiple ways. It can be intrinsic to the storage mechanism, as is the case for many technological solutions, or it can be externally maintained through liability mechanisms and processes such as discounts, buffers, and monitoring.

Carbon credits may come from projects that avoid emissions, such as funding the conservation of a land area actively under threat of deforestation, or projects that remove carbon dioxide from the atmosphere. These projects (of either credit type) may be based on natural systems or technological solutions. The IPCC projections require both the preservation of existing natural resources and a significant and rapid scale-up in carbon removals. This is why companies should both support nature-based avoided emissions projects and scale up high-quality carbon removal projects, whether technological or nature-based.

Many low-integrity credits are still on the market, and companies wishing to remain credible must exercise careful diligence in which projects they source credits from. In fiscal year 2021, Apple launched the Restore Fund, which aims to scale up high-quality nature-based carbon removal projects. We have published a white paper⁴ on the level of diligence we use for these projects, which goes beyond current frameworks and includes satellite remote sensing, detailed project manager screening, and ongoing periodic assessments, all to ensure high-quality projects.

The Restore Fund also requires both long-term monitoring (40–100 years) and a liability mechanism to compensate for the carbon impact of any reversal that does occur. Our projects also often directly benefit the surrounding local communities, as well as the upstream (for example, seedling nurseries) and downstream (for example, timber processing, paper, and packaging) value chains of our projects. This level of effort isn't yet feasible for corporations with limited resources to re-create. For our part, Apple has extended this solution to our supply chain by welcoming key suppliers as new investors in the Restore Fund. We hope that our Restore Fund provides a scalable solution until better market frameworks are created that filter out low-impact projects.

A few initiatives have come forward proposing to set such criteria, most notably the Integrity Council for the Voluntary Carbon Market (ICVCM). This is an important improvement and sets a new minimum baseline for projects. However, we believe companies will still need to supplement with additional diligence until tighter controls can be implemented. In the meantime, companies should consider utilizing the VCMI at a minimum and applying additional diligence as appropriate.

Concerning the number of credits a company should source and subsequently retire, a few frameworks provide differing guidance depending on the type of external claim the company wishes to make. We will describe these in the later section on Communication in more detail. We believe that after first working to meet its science-aligned emissions reductions, a company should plan to retire an amount of credits equivalent to its remaining footprint. Apple's 2030 commitment, after achieving the necessary 75 percent reduction in emissions, is to address what remains with carbon credits from high-quality carbon removal projects.

Obtain third-party verification

Independent third-party verification of the above actions is best practice, and as regulations develop to require emissions reporting, it will increasingly become mandatory for any statements on climate. Given the complexity involved in quantifying and tracking emissions, aligning planned reduction trajectories to the latest climate science pathways, and retiring the correct number of sufficiently high-quality carbon credits, Apple believes it is important to obtain third-party validation to provide an additional level of assurance. We utilize such validation extensively. At a minimum, companies should have their footprints verified to the standard on which their quantification is based, and may choose to have their targets verified as well.

Communication

If we summarize the recommendations so far, as gathered from various existing frameworks, a clear theme emerges for what companies should do. From that, we can then extrapolate what companies should say about their work. We believe best practice is to:

- Quantify the emissions footprint across the entire value chain, using an internationally accepted standard, like GHG Protocol or ISO 14064-1, and taking care to follow sector- or product-specific guidance, like product category rules.
- Set public targets, for both near-term reductions and long-term commitments, to stay within 1.5° C pathways following the latest climate science and, where available, leveraging sectoral decarbonization pathways such as those provided by SBTi.
- Take meaningful action to reduce the footprint as quickly as possible, prioritizing efficiency improvements and design and operational choices, and match all electricity-based emissions with renewable energy, including those in scope 3, to reserve carbon credits for non-electricity emissions.
- Counterbalance remaining emissions with carbon removal credits, sourcing only from high-quality projects, leveraging nascent frameworks, like ICVCM, and supplementing with additional diligence practices.
- Obtain third-party verification of the quantifications, credits, pathways, and targets above, as relevant and required.

And finally, companies should:

- Communicate transparently on the above in a way that encourages equivalently high-integrity action by value chain partners, competitors, industrial sectors, and governments while allowing for accountability.

Communication is critical to demonstrating integrity — the nature of climate change is global and cannot be solved by any one entity acting in isolation. Effective government policy is necessary to achieve global pathways that avoid the worst impacts of climate change. While those policies are built, voluntary action by climate-minded companies can demonstrate a high bar of what's possible and inspire broader participation by industry.

Open and transparent communication is one of the main tools we have to drive more companies to voluntarily take action. It illuminates pathways for others to follow and inspires a race to the top among competitors and throughout supply chains. Absent sufficient policies or financial incentives, the ability to communicate about achievements is a foundational incentive for participation in a voluntary effort.

Unfortunately, there are many examples of communications being abused to greenwash a lackluster approach to climate. In particular, some companies simply apply low-quality carbon credits without first making meaningful emissions reductions to market a product as “carbon neutral.” In the EU, the Empowering Consumers Directive will soon prohibit the marketing of a product as having a neutral, reduced, or positive impact on the environment if this is based on offsetting.

Given the rapidly evolving regulatory landscape, it is difficult for well-intentioned companies taking meaningful voluntary action on climate to know how to communicate their progress. Communication should drive collective progress until policy more holistically addresses the collective action problem of climate change. Based on the best practices above, we can align on a few key principles. We believe corporate communications on climate should:

- Drive competition between peers to do progressively better on climate performance, but also include detailed supplementary documentation to provide substantiation and transparency while serving as playbooks for those same peers to follow and learn from.
- Emphasize and defend the integrity of the approach used, highlighting a focus on emissions reductions and alignment with existing standards and frameworks.
- Reinforce the role that well-crafted government policy must play in long-term success on climate and, where appropriate, include descriptions of additional actions the company is taking to promote that policy framework.

Companies commonly make many types of climate claims. Below are a few of the main terms and how key stakeholders define them.

Reduced or avoided emissions

Companies should follow the GHG Protocol or ISO quantification standards and report their progress in reducing emissions relative to a clear baseline. Both institutions are either developing or have recently published additional guidance on this topic, particularly on setting an appropriate baseline. Also, in some circumstances, the term “avoided emissions” may be used to mean emissions that a manufacturer helps its customer avoid elsewhere in their footprint (for example, a building insulation manufacturer quantifies the energy its customer saves vs. a competing product), but these avoidances should not be counted against a company’s own carbon footprint. Companies should set a public target to reduce their emissions over time in alignment with a 1.5° C pathway. The Voluntary Carbon Markets Integrity Initiative (VCMI) also provides a framework to verify that their emissions are reduced in line with a 1.5° C pathway and then awards a silver/gold/platinum rating based on how much of the remaining emissions are counterbalanced with high-quality carbon credits.

Carbon Neutral

The IPCC defines global carbon neutrality as the point at which global CO₂ emissions are balanced with CO₂ removals. At the corporate level, however, this term generally refers to the climate impact of all GHG emissions, not just CO₂, expressed in terms of carbon dioxide equivalent (CO₂e). The interpretation of carbon neutral has rightly evolved beyond simply meaning GHG emissions were offset, and claims of carbon neutrality should now require companies to prioritize reductions before counterbalancing remaining emissions with carbon credits. These claims should be verified by a third party, to a standard based on either PAS 2060, which requires emissions reductions over time, or the newly published ISO 14068-1, which requires emissions reductions in line with a 1.5° C aligned science-based pathway. VCMI's platinum level also requires alignment with a 1.5° C pathway and offsetting of all remaining emissions. Finally, it is important to note that certain jurisdictions are moving to restrict or prohibit carbon neutrality claims based on carbon credits at the product level, most notably the European Union.

Net Zero

Previously, this was synonymous with "carbon neutral" and simply referred to the state where a company's net footprint (GHG emissions minus offsets) equaled zero. In recent years, however, the two terms have diverged, where "carbon neutral" describes the journey and "net zero" describes the goal. It is generally defined as a 90 percent reduction in emissions, with the remainder counterbalanced by carbon removal credits, and is to be achieved no later than 2050. Achieving this level of deep decarbonization will require entire industries and economies to decarbonize and reinforces the need for collective action by all entities. It's generally not expected that any companies will have reached net zero in the near term, so for now, most communications and frameworks are limited to setting net-zero targets. A best practice is to look at leading frameworks such as SBTi's Net Zero target-setting criteria or the ISO International Workshop Agreement 42, which, while not a standard, is expected to be revised in the coming years to become a verifiable set of criteria.

Conclusions

In this paper, we provide guidance on best practices that Apple has identified and we believe are useful for companies to follow. We believe companies should use internationally recognized quantification standards, prioritize emissions reductions within their value chain, finance additional reductions and emissions removals outside their value chain, consider setting public targets, obtain third-party verification of their work, and communicate transparently about their efforts. In particular, companies should utilize leading frameworks, including GHG Protocol, ISO, SBTi, ICVCM, and VCMi.

We additionally emphasize that companies must continue communicating to inspire and challenge their peers to increase their own ambitions. Ultimately, corporate action is nearly all voluntary, and the ability to make public claims is one of the main incentives that drive this corporate action. We also stress that such individual voluntary actions are likely to be insufficient in the long run without equivalent governmental support, as policy is necessary to achieve the scale of global decarbonization needed to avoid the worst impacts of climate change. We believe that corporate communications on climate, when based on high-integrity climate activities as detailed here, can spur additional voluntary corporate climate actions by value chain partners and peers. In doing so, we hope our industries may buy sufficient time until global leaders transition to the policy-driven climate action framework that is ultimately necessary.

References

¹IPCC “Summary for Policymakers of IPCC Special Report on Global Warming of 1.5° C approved by governments,” press release, October 8, 2018, [ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments](https://www.ipcc.ch/2018/10/08/summary-for-policymakers-of-ipcc-special-report-on-global-warming-of-1-5c-approved-by-governments)

²paia-tool.com

³Relevant product category rules may be found in ISO, IEC, or other international or national standards.

⁴Apple Inc. “Apple’s Carbon Removal Strategy”, January, 2024, apple.com/environment/pdf/Apples_Carbon_Removal_Strategy_White_Paper.pdf

This paper was originally presented at the Electronics Goes Green Conference in June 2024 by Ryan Maloney and Chris Busch.