Apple’s Product Use Electricity Strategy

u 2 24

Table of Contents

Introduction

Apple 2030:
Our commitment to be carbon neutral for our entire footprint by the end of the decade

We have an ambitious commitment and a science-based plan to reach our Apple 2030 goal. Our journey to 2030 centers on reducing our scope 1, 2, and 3 emissions — upstream and downstream — by 75 percent compared with 2015, then investing in high-quality carbon removal solutions for the remaining emissions. We're focused on decarbonizing the three largest sources of emissions across our value chain: materials, electricity, and transportation. We're prioritizing efforts to drastically reduce these emissions before applying high-quality, nature-based credits. We're also committed to working toward reaching a 90 percent reduction in emissions from our 2015 baseline by 2050.

To learn more, visit apple.com/environment.

In 2020, we reached carbon neutrality for our corporate operations, and we set an even more ambitious goal to be carbon neutral across our entire carbon footprint by the end of the decade. Our journey to 2030 centers on reducing our emissions by 75 percent compared with 2015 before balancing the remaining emissions with high-quality carbon removals. As part of our goal, we're addressing the emissions tied to the electricity consumed globally through our customers' use of our products, which in 2023 we estimated to represent 4.65 MMT of CO_2e. By 2030, our initiative will bring an estimated 5 gigawatts (GW) of renewable energy online globally — and it will expand as needed to meet our goal.

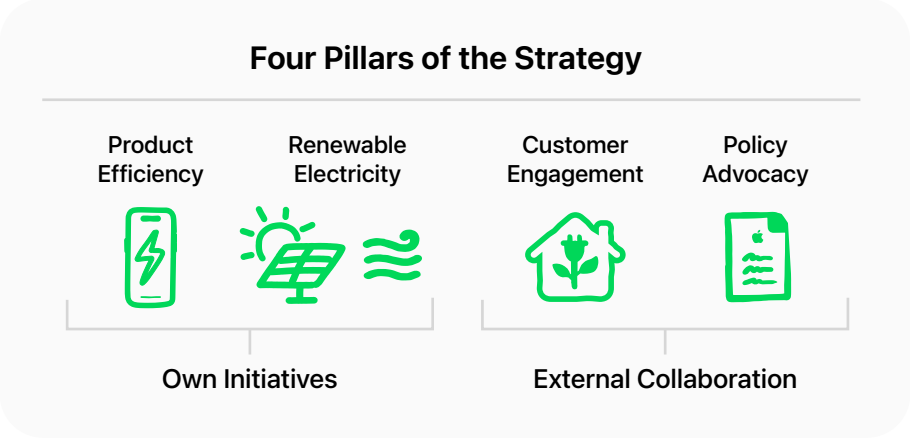
Product use emissions are defined in the *Technical Guidance for Calculating Scope 3 Emissions*, category 11, under the Greenhouse Gas Protocol (GHGP), as "emissions from the use of goods and services sold by the reporting company in the reporting year."[1] Because customer use of Apple devices varies and is geographically dispersed, these emissions are different in nature from our scope 2 operations and scope 3 supply chain emissions, which are more concentrated.

Tackling diffuse, downstream product emissions is challenging because we have limited visibility on actual electricity consumption or control over how much clean energy customers are using to charge and power Apple's installed based of over 2.2 billion active devices.

Best practices for addressing product use emissions are rapidly evolving. And while the GHGP exists to guide companies, there's not yet a standard approach that's universally applicable across all businesses. Given the urgent need for corporate climate action, we're proactively addressing our users' product use emissions today by considering existing guidance in the unique context of our product energy load.

And because we want to help create new industry best practices, we're sharing our approach in this paper as a contribution to the ongoing dialogue around corporate action to address customer energy use. Our strategy focuses on actions that Apple is taking, as well as engaging with other stakeholders to support grid decarbonization more broadly. Our current scope 3 product use emissions strategy is centered on the following four pillars:

- Improving product-level energy efficiency
- Supporting renewable electricity projects globally that maximize carbon impact, aiming to avoid as much carbon as charging and powering our devices emit
- Engaging with our customers to educate and provide opportunities to support decarbonizing the grid
- Continuing to advocate for energy policies that expedite the development and use of renewable energy around the world — critical for both our 2030 goals and for avoiding the worst impacts of climate change



Minimizing Carbon Emissions from Product Use

Making our products more energy efficient reduces their carbon emissions. Our work on efficiency began well over a decade ago and remains an essential part of our environmental strategy going forward. We approach energy efficiency in the earliest phases of design, taking a holistic view of each product — from how efficiently the software operates to the power requirements of individual components.

With each generation of products, we strive to improve energy efficiency. For example, the transition to Apple silicon in our products continues to drive these improvements — and our pro chips released in 2023 enabled more Mac devices to run with improved energy efficiency. And with the A15 Bionic chip, Apple TV 4K (3rd generation) is using nearly 30 percent less power than the previous generation while achieving more powerful performance.[2]

We've cut overall product energy use across all major product lines by more than 70 percent since 2008.[3] And Apple products are consistently rated by ENERGY STAR, which sets specifications that reflect the 25 percent most energy-efficient devices on the market. In 2023, all eligible Apple products continued to receive an ENERGY STAR rating for superior energy efficiency[4] and met requirements for EPEAT registration, another environmental rating system for electronic products that considers energy efficiency and a number of other environmental topics.[5] For example, iPhone 15 uses 47 percent less energy than the U.S. Department of Energy's requirements for battery charger systems.[6] And Mac mini uses 72 percent less energy than the ENERGY STAR requirement.[7]

Expanding Renewable Electricity Capacity

Our goal is to match 100 percent of our scope 3 product energy use in gigawatt-hours (GWh) with clean energy and maximize the carbon impact of our solutions, aiming to avoid as much carbon as charging and powering our devices emit. Through directly owned projects, equity investments, and long-term power purchase agreements (PPAs), Apple's product use initiative will bring renewable energy generation online to match the electricity that customers use to charge and power our devices globally with 100 percent clean energy by 2030. As we work toward this objective, we'll:

- Make significant investments in renewable energy projects globally
- Maximize the carbon our projects avoid by choosing project locations with higher carbon intensity per megawatt-hour (MWh)
- Engage with other stakeholders to drive industry alignment on methodologies to measure scope 3 product use emissions and to improve data needed to inform project impact measurement

Renewables have long been an important part of Apple's environmental strategy across our operations, our supply chain, and now the use of our products.[8] When Apple committed to running our business on 100 percent renewable energy in 2013, which we achieved in 2018, we were early leaders in the transition to renewable energy. We also launched the Supplier Clean Energy Program in 2015 to advance renewable energy throughout our manufacturing supply chain, and as of March 2024, more than 320 suppliers have committed to sourcing renewable electricity for Apple production, representing 95 percent of our direct supplier spend.

In developing our product use mitigation approach, we considered learnings from our existing programs, international standards, and the opportunity to play a role in helping create new industry best practices. As the renewables landscape evolves, we're updating our thinking and seeking new innovative solutions.

Scope 3 product use emissions are unique compared with different types of emissions we've addressed in the past because our load is mobile and highly geographically dispersed. This makes the concept of "local renewables," or regionality, that we've applied for our scope 2 and our suppliers' scope 2 emissions too dynamic to manage at scale.

For scope 2 emissions, today we strive to procure renewables in the same grid where the energy is consumed, whether physically onsite at large facilities like Apple Park or in the same utility grid or country for offsite utility-scale projects, where feasible. This principle is in line with current GHGP industry best practices for scope 2 emissions.[9]

This paper is focused specifically on our scope 3 product use emissions. Since these product use–related emissions are less regionally stationary than scope 2 or other scope 3 upstream sources, we're following a principle of geographic flexibility to maximize carbon impact. As it has become increasingly clear that grid carbon intensity varies around the world, we have the ability to prioritize the creation of projects that deliver even greater carbon impact than a strictly regional approach would provide. As best practices for addressing product use emissions take shape, we're working to identify ways that our renewable energy projects for product use are matching megawatt-hours, per GHG Protocol requirements, while additionally optimizing the carbon impact to help shape best practices for our industry.

Creating New Renewable Energy Projects

We'll need to bring an estimated 5 GW of renewable energy online by 2030.

One of the most meaningful ways to decarbonize the global electricity system between now and 2030 is to encourage the development of new renewable energy generation. According to the International Energy Agency (IEA), global annual renewable capacity additions increased by almost 50 percent in 2023. And over the next five years, the share of wind and solar PV capacity will double, with renewable energy accounting for 42 percent of global electricity generation by 2028.[10] But even this impressive growth is not sufficient to achieve the world's climate goals. At the United Nations Climate Change Conference (COP28) in Dubai, the nations of the world agreed that the global installed renewable energy generation capacity must triple to reach at least 11,000 GW by 2030.[11]

We'll need to bring an estimated 5 GW of renewables online by 2030, and we'll make additional investments as needed to meet our goal of matching the electricity used to charge and power our devices globally with clean energy.

Curtailment — or wasted renewable energy due to local electricity supply exceeding demand — is becoming a challenge in certain regions with rising renewable energy generation. As renewable penetration increases in the coming decades, we're starting to invest in storage for our renewable generation during times and in places where generation is starting to be curtailed to pave the way for higher penetration renewables. For example, we added a 240 MWh battery to our California Flats solar project in 2021.

Maximizing Impact Through Geographic Flexibility

We're exploring how we can invest in renewable energy projects worldwide. Our objective is to not only match product use with clean energy but also maximize the carbon impact of our projects, aiming to avoid as much carbon as charging and powering our devices emit.

The climate impact of a new renewable electricity project depends on the location, due to the marginal electricity generator (for example, coal, gas, and so on) that the new project pushes off the grid. Additionally, in some places, nearly all power plants developed today are renewable, and even if Apple doesn't support renewable energy projects in these locations, projects will continue to be developed and the clean energy market will continue to grow. In other places, many power plants built today are still fossil fuel plants that emit carbon. Through our investments, we have an opportunity to support renewable projects that might not otherwise be developed in these communities without policies to support renewable energy in the near term.

In addition to reducing emissions, investments in areas with fewer renewables can also help advance social equity by creating jobs and helping reduce pollution that disproportionately impacts health in some underserved communities. Research shows that 95 percent of renewable energy capacity is built in the wealthiest nations,[12] so the opportunity to help bring renewables to more places around the world is significant. And all grids still have a long way to go with respect to decarbonization.

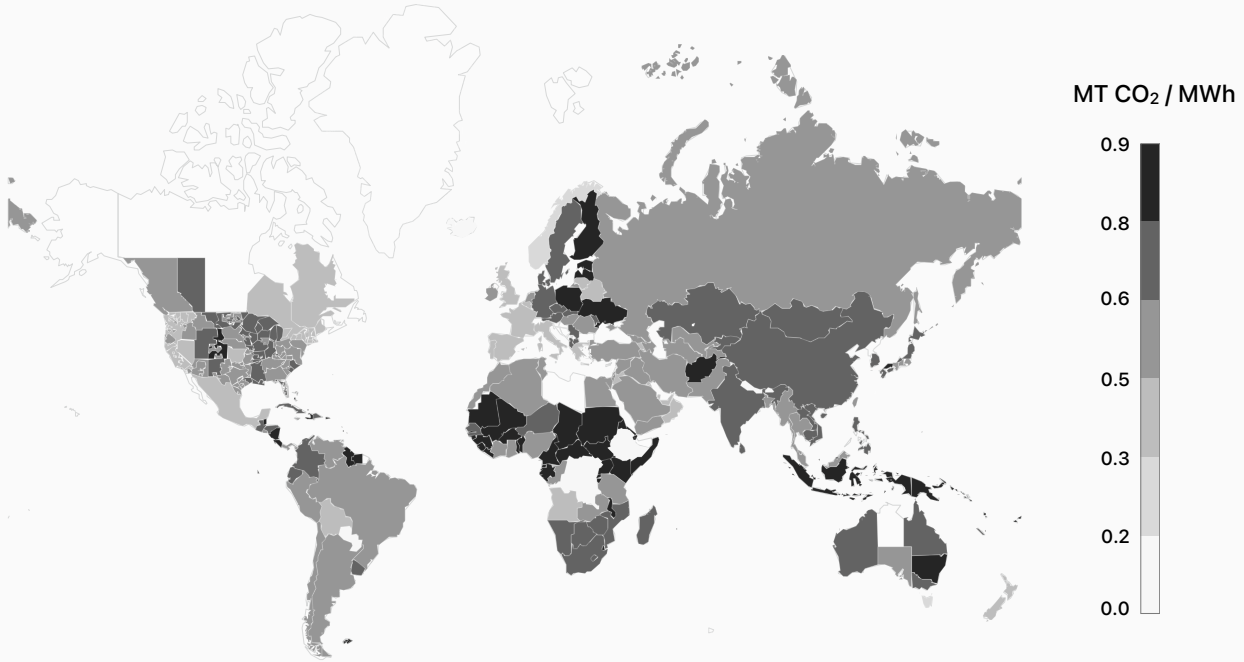
We're also working to avoid negative impacts on biodiversity, sensitive habitats and affected communities, and we've adopted a global internal selection procedure for our renewable energy projects, which includes:

- Requiring each developer to provide an environmental and social impact assessment
- Engaging our own independent, third-party consultant to conduct a review of that developer's assessment and to review ancillary reports and permits and to perform a desktop analysis that references publicly and privately available information
- Flagging criteria early in the transaction process to allow for any necessary studies, reports, baseline or monitoring criteria
- Incorporating compliance language and reporting obligations in the transaction documents and applying Apple's Supplier Code of Conduct
- Engaging external consultants to benchmark against the International Finance Corporation's (IFC's) Performance Standards and working to develop a management program to mitigate key material gaps

As part of final approval for any project, Apple has developed an internal matrix by which any yellow or red-flagged concerns that remain are escalated to senior management internally for further scrutiny. Apple looks most favorably on projects that go beyond avoidance of harm and try to positively impact the environment and community.

To address Apple's product use electricity, we will first include residual grid mix where credible data exists. For the remaining electricity our products use, we plan to match 75 percent with renewable electricity from within the three broad geographic regions where the majority of our devices are sold - the U.S., Europe, and Asia Pacific. Within each of these regions, we will prioritize generation in subregional grids that have the highest estimated carbon intensities per megawatt-hour, as shown in the map below. For the remaining 25 percent, we will maintain flexibility to invest in locations that maximize carbon, social, and other project impacts, regardless of regionality and the number of Apple devices sold in the country. Combined, our goal is to match 100 percent of the total gigawatt-hours required for our scope 3 product use with clean electricity, while also optimizing for the total positive impact on the global climate.

Renewable Energy Estimated Project Impact per Megawatt-Hour



The map estimates the carbon impact of building a renewable energy project in a specific country or region. Project impact assumes a 95 percent operating margin and 5 percent build margin ratio. The operating margin data include electricity imports and exports between countries, so results may differ from estimates which do not consider trade across national borders. For example, the high impact of building in Sweden reflects the ability to export to other European countries with fossil intensive grids.

Sources: Operating Margin from WattTime, "Methodology + Validation," watttime.org/data-science/methodology-validation; Build Margin from UNFCCC, "List of harmonized GHG accounting standards/approaches and guidelines developed," unfccc.int/climate-action/sectoral-engagement/ifis-harmonization-of-standards-for-ghg-accounting/ifi-twg-list-of-methodologies.

Modeling Impact

Our estimate of total electricity consumed by our devices informs the amount of clean energy we need to bring online. Today we don't count residual grid mix for our scope 2 operations and scope 3 supply chain commitments, as we've committed to mitigating our own electricity emissions with 100 percent renewable energy regardless of the amount of renewable energy on the grid. But when we consider the electricity used by our customers to charge and power their Apple products, we recognize that public renewable energy programs and policies like Renewable Portfolio Standards in the U.S. are specifically meant to decarbonize the electricity mix for the general public (for example, our customers). Therefore, we'll count clean electricity residual grid mix for product use where credible data on this mix exist,[13] and we'll match the remainder of the gigawatt-hours consumed by our products with new renewable energy projects.

Under the GHGP's current standard for inventory accounting, a company can counterbalance its electricity-related emissions only by matching 100 percent of the megawatt-hours used annually. Separately, the GHGP's *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects* gives companies optional ways to quantify the actual avoided carbon emissions of the renewable energy projects they support.[14]

Our target to annually match megawatt-hours for product use is in line with the GHGP guidance, and our focus on maximizing avoided carbon emissions goes beyond it. We'll calculate the estimated carbon impact and avoided emissions rate of our projects based on the following equation:

New Project Avoided Emissions Rate = w (Build Margin) + (1 – w) (Operating Margin)

w = weight between 0 and 1 assigned to the build margin

The main components are defined as follows:

- Operating margin (OM), also known as the marginal operating emissions, representing the emissions per megawatt-hour of the generation displaced from existing operating power plants
- Build margin (BM), representing the average emissions of the new capacity portfolio, whose construction is avoided due to the renewable project being built
- *w* represents the weighting between OM and BM, adding up to a total of 100 percent

The science and data for calculating project emissions impact are advancing. Currently, the different models available produce different estimates for the precise emissions impact of a project, and the appropriate weighting between OM and BM remains an ongoing discussion.

Alignment is beginning to form that BM measures a project's long-run effects on structural change, but it may have little to no effect in the short term. Based on the importance of structural change but the uncertainty of the science, as of today we'll use a 100 percent OM in the year the project comes online, then subsequently increase the BM weight relative to the OM over time. The BM emission factor is fixed the year the project comes online, while the OM value will update annually.

This important topic needs further research. We always seek the most accurate information about how to reduce carbon, and we'll continue to balance using the best information available at the time while supporting ongoing research. This includes our involvement in Validating Emissions Rates for Accurate Consequential Impact Taskforce (VERACI-T) and joining ZEROgrid to deepen our understanding, as well as that of other companies, about the effects of renewable energy projects on carbon emissions. We'll continue to support work aimed at identifying marginal emission factors and achieving industrywide consensus on the most meaningful, accurate, and validated marginal emission factor calculation methodologies through stakeholder groups. And we'll continue to engage with others to share our thoughts on how guidelines should continue evolving to encourage companies to make renewable energy procurement decisions that prioritize impact.

Transition toward a global clean energy grid

Over the last decade, more companies have pledged to run on 100 percent renewable energy — matching the electricity consumed for their direct operations with renewable energy generated on an annual basis. And as more renewables have been added to the grid and better emissions data have become available, it has become increasingly clear that not all megawatt-hours are created equal from a carbon impact standpoint. We agree with a number of industry stakeholders on the importance of considering the carbon impact of increased temporal granularity — for example, hourly loads and hourly generation. It's part of our approach to expanding renewable capacity and how we engage our devices' users to shift their electric demand to times when energy is cleaner to support the decarbonized grid of the future, as discussed in the next section.

While the concept of 24/7 clean energy is an important long-term societal objective for grids around the world, today most grids are far from having enough renewable energy online for utilities to begin optimizing for 24/7 clean energy. To reach that objective, each stakeholder has a role to play. Companies need to bring new renewables online to make 24/7 systemwide low-carbon grids possible. Energy customers can support by shaping their flexible load to match times when renewables generate, and encouraging this is also part of our strategy. And utilities and grid operators will continue to coordinate and optimize for a cost-effective and reliable system to support grid decarbonization.

We believe 24/7 clean energy needs to be tackled at a systemwide level, and it's inefficient for individual actors to each try to create their own bespoke 24/7 portfolio. Therefore, our focus is to bring as much renewable energy online as possible while paying attention to the hourly emission effects of our load and our generation, with the aim of mitigating all the carbon. Apple is committed to playing our role to make a systemwide solution possible.

Engaging with Customers on Energy Use

Clean Energy Charging optimizes for when the grid is using cleaner energy sources with lower emissions.

Grid Forecast in the Home app shows customers when cleaner electricity is available from the grid, empowering them with information to help reduce greenhouse gas emissions.

In addition to designing our products to be more efficient and investing in renewables, we're empowering our customers to address emissions from the electricity used to power or charge Apple devices by helping enable their flexibility, contributing to grid decarbonization more broadly. At the same time, Apple devices represent a tiny fraction of the average household's overall carbon footprint. Eliminating the carbon impact of Apple devices on behalf of our customers by matching it with renewable energy is an entry point to helping our customers meaningfully reduce their household emissions. Many consumers care about their environmental impact,[15] and we're committed to empowering our customers to participate in carbon reduction with us — in addition to, but not as a substitute for, Apple's efforts. As we support our customers to address their home energy emissions, we keep working toward our own ambitious goal to be carbon neutral across our entire carbon footprint by 2030.[16]

In fall 2022, we launched Clean Energy Charging for iPhone in the contiguous U.S. This feature enables iPhone users to selectively charge their devices at times of the day when renewable resources are available and the electric grid is relatively cleaner. Today, when iPhone is connected to a charger, it follows a forecast of the carbon emissions in the user's local energy grid and uses it to charge during times of cleaner energy production.[17] Clean Energy Charging is one example of how customers can shift and shape load to times when cleaner energy generates fewer emissions. We plan to continue evolving this feature over time and incorporating additional impactful data sets that enable load shifting to support cost-effective grid decarbonization.

As we continue to engage our customers in the clean energy transition, we're focusing on home energy as one of the largest opportunities to effect change. In fall 2023, Apple launched a new category within the Home app, called Energy, and within it, the Grid Forecast feature in the U.S. Grid Forecast allows users to see when shifting their electricity use may help lower carbon emissions. That's because the electricity powering customers' homes comes from different sources throughout the day, including renewable energy like solar and wind, or fossil fuels like coal and natural gas. Grid Forecast highlights times when electricity from cleaner sources is available on the grid, so users can reduce the emissions generated when charging or powering devices in the home. Grid Forecast currently uses WattTime marginal emissions and curtailment data,[18] and we'll continue to evaluate additional data inputs to refine Grid Forecast over time. Grid Forecast is available on iPhone, iPad, Mac, and Apple Watch, as well as through widgets and Apple Watch complications.[19]

Grid Forecast is our initial step in helping our customers understand that *when* you use electricity matters. Customers can make a positive impact on their household footprint by choosing to run the dishwasher or charge an electric vehicle at a time when the grid is cleaner. When scaled across many households, these decisions can have a sizable ripple effect. Because many of our customers care about their own climate impact, there's an exciting opportunity for this technology to help them make more informed decisions.

In 2024, we're making the Energy category within Home app more personal and actionable by integrating users' home electricity usage directly into the experience. We're partnering with leading utilities to make it easier for users to access and understand this information. Users can view their home electricity usage over time and see how it's trending; if they're on a rate plan where electricity prices vary during the day, they can see how much electricity they used during lower- and higher-cost periods; and if they have rooftop solar, they can see when they used electricity from the grid — and when they send it back. In addition to being accessible in the Home app, this energy information will also be available via widgets on iPhone, iPad, and Mac, and Apple Watch complications.

In the Home app's Energy category, users can now easily view their electricity usage when they connect their utility account.

Utilities play a critical role in the transition to an affordable, reliable, and decarbonized electricity grid. By partnering with utilities, we can incorporate a customer's utility information into a personalized home energy management experience. We announced these new features with our first utility partner, PG&E, in California, and we're working with more utilities to support additional homes in the future.

We envision a world where we can help customers better understand electricity and how they can change their usage over time to support the transition to a clean energy grid. Building tools that help users understand their home electricity is an important next step in this process. But it is just the beginning. Looking ahead, we will continue to identify more ways to engage our users to join utilities, device makers, grid system operators, and regulators in the global effort to decarbonize our energy sector.

Advocating for Supportive Policies

Beyond our efforts to engage customers on clean energy and our investments in renewable energy projects, grid decarbonization requires a fundamental transformation of the electricity sector, which isn't possible without significant policy change. We support thoughtful policies that directly help overcome barriers to renewable deployment and, if enacted, will have far-reaching impacts on emissions from electricity use. Going into COP28, we supported a tripling of global renewable energy capacity by 2030 to 11,000 GW,[20] in line with the IEA's Net Zero Emissions by 2050 (NZE) Scenario.[21] But we recognize that achieving this ambitious goal requires substantial investment by corporate actors and utilities, as well as improved governmental policies.

The policies with the greatest potential to increase renewable energy deployment vary by region and country. The most commonly needed market support mechanisms include:

- Creating a level playing field for renewable energy, taking into account the carbon reduction benefits and using carbon pricing to drive emissions reductions
- Providing financial incentives and tax credits for renewable energy
- Improving access to financing and capital
- Investing in grid infrastructure, including addressing administrative and permitting barriers
- Establishing renewable electricity deployment targets
- Developing credible and transparent systems for issuing, tracking, and certifying competitively priced environmental attribute certificates

In the U.S., we've long supported grid decarbonization efforts, including Environmental Protection Agency (EPA) rules aimed at decreasing the carbon intensity of existing grid resources, while simultaneously increasing investments in renewable energy. In markets like Korea and Japan, Apple has supported efforts to set a higher target for renewable energy in national energy plans, to establish a more fair competitive market for renewables, and to improve carbon pricing.

Looking ahead, we believe the following policy areas remain critical in driving global grid decarbonization progress in support of Apple's product use initiative:

- **Transmission**: A lack of transmission capacity exists to connect the areas with the best renewable generation potential to major load centers. In the U.S., we're advocating for more transmission capacity and the use of grid-enhancing technologies to help expedite interconnection processes because wait times to connect new generation to existing transmission lines now average four years.[22] Increased high-capacity, long-distance transmission will also improve the grid's resilience and reliability by enhancing power flow between regions during extreme weather events and balancing renewable resources across wider geographic areas.
- **Load flexibility**: As electricity supply becomes more variable with the increase of renewable generation, there's an increasing need for flexible demand. Policies that encourage residential customers to reduce and shift electricity demand have the potential to not only decrease the total amount of electricity used but also shift usage from peak to off-peak times. When electricity demand is at its peak, grid operators need to bring additional resources online to generate more power, and the most common source of generation for a "peaker plant" is natural gas. If consumers can shift their electricity usage to off-peak times, their demand can more likely be met with the renewable resources that are available at that time. Additionally, these times of peak electric demand are the most expensive and risky for grid operators, and load flexibility can mitigate both of these risks to enable a faster, more reliable and cost effective transition to deep grid decarbonization. Strong public policies can create the conditions to incentivize load shifting on a large scale. Enabling distributed energy resources (DERs) to participate in electricity markets with fair compensation can foster the growth of virtual power plants (VPPs). VPPs allow for the aggregation of DERs, which supports scale and improves grid resiliency and reliability. And expanding dynamic tariff plans, like realtime pricing or time-of-use (TOU) rates for residential customers, can reduce electricity bills, if households have the ability to manage load associated with these rates.
- **Standards**: We support standards that require certain amounts of clean or renewable electricity on the grid, such as U.S. Renewable Portfolio Standards (RPS) and grid carbon reduction standards. Ambitious standards can drive renewable adoption at the state and national levels. As these standards get adopted, it's critical to provide supporting stable frameworks that incentivize corporate investment and enable corporations to operate jointly in support of decarbonizing grids, rather than in competition with programs such as utility renewable energy targets.

- **Data access and quality**: Policies that encourage the availability of accurate emissions and customer usage data can empower customers to reduce their carbon emissions and save money on their electric bills. Supporting data availability includes funding and deploying advanced metering infrastructure (AMI) for more customers. Residential smart meters provide the data needed to support dynamic rate structures and load flexibility programs. Electricity customers should be able to easily view and share their electricity usage data with third parties with permission. And improving data access and quality will unlock innovation for companies working to help customers manage their electricity usage.

These and other policy opportunities can help level the playing field for renewable electricity when compared with nonrenewable sources, leading to grid decarbonization and playing a key role in avoiding the worst impacts of climate change.

Conclusion

We designed our product use initiative to create a ripple in the pond. While the steps we're taking to improve product efficiency and invest in renewable projects are significant, we know we can accomplish even more by collaborating with others.

With the goal of decarbonizing global grids as quickly as possible, we hope that other companies can benefit from understanding our strategy as they develop their own product use approach. Addressing emissions from the energy use phase of products is a rapidly developing area, and by sharing our approach, we want to contribute to our industry's efforts to learn from one another and develop even more innovative and impactful initiatives. As more companies focus on this portion of their footprint, the potential impact is significant.

Our efforts to help customers understand how to use energy more efficiently are expanding beyond charging and powering Apple devices to include overall household electricity use. And advocating for supportive policies can make a wider contribution to creating the conditions that our world needs to support the clean energy transition.

Endnotes

[1] Greenhouse Gas Protocol, "Category 11: Use of Sold Products," in *Technical Guidance for Calculating Scope 3 Emissions* (2013), ghgprotocol.org/sites/default/files/standards/Scope3_Calculation_Guidance_0.pdf.

[2] Testing was done under the condition of streaming 4K movies played on Apple TV 4K (3rd generation) with the Siri Remote from the Apple TV app.

[3] Based on sales-weighted averages of Mac, iPad, iPhone, Apple Watch, Apple TV, HomePod, AirPods, and Beats.

[4] Eligible products are those in a product category for which ENERGY STAR certification exists. For more information, visit www.energystar.gov. ENERGY STAR and the ENERGY STAR mark are registered trademarks owned by the U.S. Environmental Protection Agency.

[5] Apple lists eligible products sold in the United States and Canada on the Electronic Product Environmental Assessment Tool (EPEAT) Registry. Eligible products are those in a product category for which EPEAT registration exists, including workstations, desktops, laptops, displays, mobile phones, and tablets. For more information, visit www.epeat.net.

[6] Efficiency performance is based on Energy Conservation Standard for Battery Charges by the U.S. Department of Energy. Note that ENERGY STAR does not certify smartphone devices. The energy efficiency values are based on the following conditions:

- Power adapter, no load: Condition in which the Apple 20W USB-C Power Adapter with the USB-C to Lightning Cable (1 m) is connected to AC power but not connected to iPhone.
- Power adapter efficiency: Average of the Apple 20W USB-C Power Adapter with the USB-C Charge Cable (1 m) measured efficiency when tested at 100 percent, 75 percent, 50 percent, and 25 percent of the power adapter's rated output current.

[7] Energy consumption and energy efficiency values are based on the ENERGY STAR Program Requirements for Computers, including the max energy allowance for Mac mini. For more information, visit www.energystar.gov. ENERGY STAR and the ENERGY STAR mark are registered trademarks owned by the U.S. Environmental Protection Agency. For more information on the power consumption of Mac mini, read the Mac mini Product Environmental Report.

[8] See our Environmental Progress Report for more information on renewables for our facilities and supply chain.

[9] As of this paper's publication in June 2024.

[10] International Energy Agency, "Executive summary," *Renewables 2023: Analysis and Forecast to 2028* (Paris, January 2024), www.iea.org/reports/renewables-2023/executive-summary. Renewable energy is defined by the IEA to include wind, solar PV, and hydro.

[11] COP28 UAE, Global Renewables and Energy Efficiency Pledge, www.cop28.com/en/global-renewables-and-energy-efficiency-pledge.

[12] Open Access Government, "Study finds 95% of renewable energy capacity in richest countries," August 9, 2021, www.openaccessgovernment.org/decarbonisation-race/117121.

[13] "The mix of energy generation resources and associated attributes such as GHG emissions in a defined geographic boundary left after contractual instruments have been claimed/retired/canceled. The residual mix can provide an emission factor for companies without contractual instruments to use in a market-based method calculation." It Includes renewable energy, hydro, and nuclear. World Resources Institute, *GHG Protocol Scope 2 Guidance*, 2015, ghgprotocol.org/sites/default/files/2023-03/Scope%202%20Guidance.pdf.

[14] World Resources Institute, *Guidelines for Quantifying GHG Reductions from Grid-Connected Electricity Projects*, August 2007, files.wri.org/d8/s3fs-public/pdf/ghgprotocol-electricity.pdf; UNFCCC, *GHG Accounting for Grid Connected Renewable Energy Projects*, July 2019, unfccc.int/sites/default/files/resource/Renewable Energy_GHG accounting approach.pdf.

[15] James Bell, Jacob Poushter, Moira Fagan, and Christine Huang, "In Response to Climate Change, Citizens in Advanced Economies Are Willing To Alter How They Live and Work," Pew Research Center, September 2021, www.pewresearch.org/global/2021/09/14/in-response-to-climate-change-citizens-in-advanced-economies-are-willing-to-alter-how-they-live-and-work.

[16] Read more about Apple's goals and initiatives in our Environmental Progress Report.

[17] Today this forecast is powered by WattTime Marginal Operating Emissions Rate (MOER) data, which represent the emissions rate of the electricity generator(s) that are responding to changes in load on the local grid at a certain time. It is the same data as the OM signal mentioned on page 10. WattTime is a nonprofit raising awareness about the CO_2 impacts of when we use electricity, where we site wind and solar projects, and identifying suppliers conscious about emissions.

[18] Cleaner energy times may indicate one of two scenarios: (1) Times when renewables in a user's region are being curtailed because wind and solar are producing more energy than the grid can use. Shifting electricity use to these times can result in more wind and solar power being utilized instead of wasted. (2) Times when shifting electricity may result in lower-emissions generators serving an increase in demand known as the MOER. At any given moment, many different generators provide electricity to the grid, but only a few, or even just one, specific generator will provide the additional electricity needed. The marginal emissions rate estimates the carbon emissions from the particular set of generators that turn on when a user increases their usage or turn off when they decrease their usage. Today the cleaner times in Grid Forecast represent times when the MOER in a user's region is lower compared with the rates on previous days.

[19] For guidance on how to add a complication to your watch or a widget to your iPhone, see Apple's iPhone User Guide or Apple Watch User Guide.

[20] Open Letter from over 250+ Organisations Calling for a Target at COP28 to Triple Renewable Energy Capacity to at Least 11,000 GW by 2030, Global Renewables Alliance, September 2023, UN General Assembly and New York Climate Week, globalrenewablesalliance.org/wp-content/uploads/2023/09/cop28_open_letter_on_tripling_renewables_with-logo_v7.pdf.

[21] International Energy Agency, "Net Zero Emissions by 2050 Scenario (NZE)," *Global Energy and Climate Model* (Paris, October 2023), www.iea.org/reports/global-energy-and-climate-model/net-zero-emissions-by-2050-scenario-nze.

[22] Lawrence Berkeley National Laboratory, *Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection*, April 2024, emp.lbl.gov/queues#:~:text=Interconnection. Wait times are also for projects built in 2023.