With **21 gaming companies pledging to reduce their carbon footprint by more than 30 million tonnes by 2030** through greener features and offset emissions, Console Carbon Footprint reveals why reducing plastic packaging is crucial to combatting climate change...

GLOBAL PLASTIC WASTE

91% of the 8.3 billion metric tonnes of plastic that has ever been produced isn't recycled

If current trends continue, there will be 12 billion metric tonnes of plastic in landfills by 2050

PHYSICAL VS DIGITAL

When looking at the materials used to produce physical games and the electricity used for digital downloads, it reveals

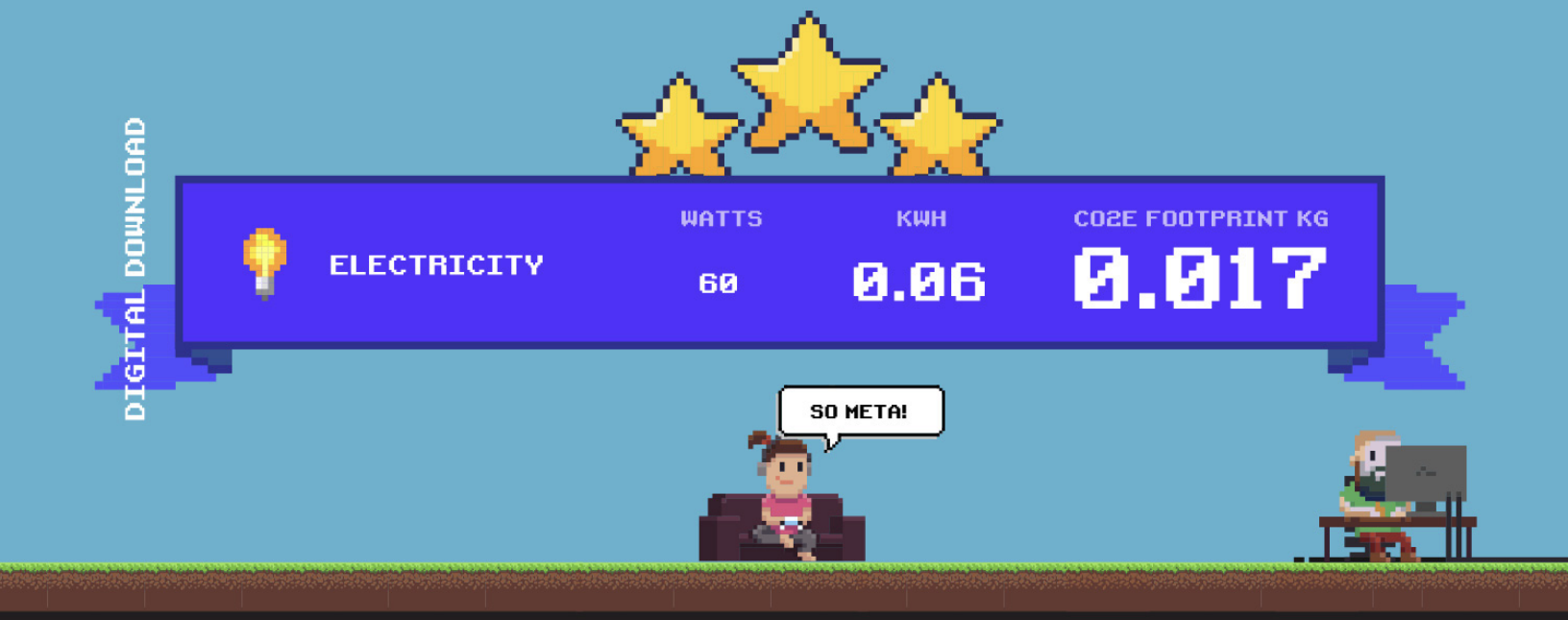
that **physical copies emit more than 23 times the CO2 of downloads.**

PHYSICAL GAME

	MATERIALS	WEIGHT	CO2E FOOTPRINT KG
DISC	ALUMINIUM POLYCARBONATE	15G	0.11
PLASTIC CASE	POLYPROPYLENE POLYETHYLENE	53G	0.26
PRINTED COVER AND LEAFLET	GLOSSY PAPER	5G	0.02

DIGITAL DOWNLOAD

	WATTS	KWH	CO2E FOOTPRINT KG
ELECTRICITY	60	0.06	0.017



POPULAR GAME EMISSIONS

Looking at the most popular game titles over the last year reveals **FIFA 19 is responsible for 912,581kg of CO2**, based on physical sales and digital downloads.

FIFA 19

NO. OF PHYSICAL UNITS SOLD
1,889,401

NO. OF DIGITAL DOWNLOADS
9,224,723

TOTAL CO2 EMISSIONS FOOTPRINT KG
912,581

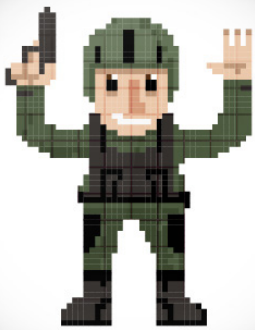
RED DEAD REDEMPTION 2

NO. OF PHYSICAL UNITS SOLD
1,757,212

NO. OF DIGITAL DOWNLOADS
8,579,329

TOTAL CO2 EMISSIONS FOOTPRINT KG
848,733

CALL OF DUTY: OPS 4



NO. OF PHYSICAL UNITS SOLD
1,172,855

NO. OF DIGITAL DOWNLOADS
5,726,292

TOTAL CO2 EMISSIONS FOOTPRINT KG
566,489

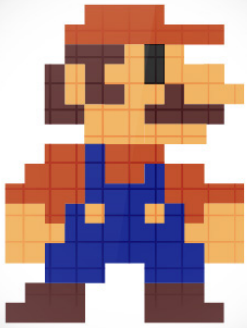
MARVEL'S SPIDER-MAN

NO. OF PHYSICAL UNITS SOLD
676,621

NO. OF DIGITAL DOWNLOADS
3,303,503

TOTAL CO2 EMISSIONS FOOTPRINT KG
326,808

MARIO KART 8 DELUXE



NO. OF PHYSICAL UNITS SOLD
458,675

NO. OF DIGITAL DOWNLOADS
2,239,413

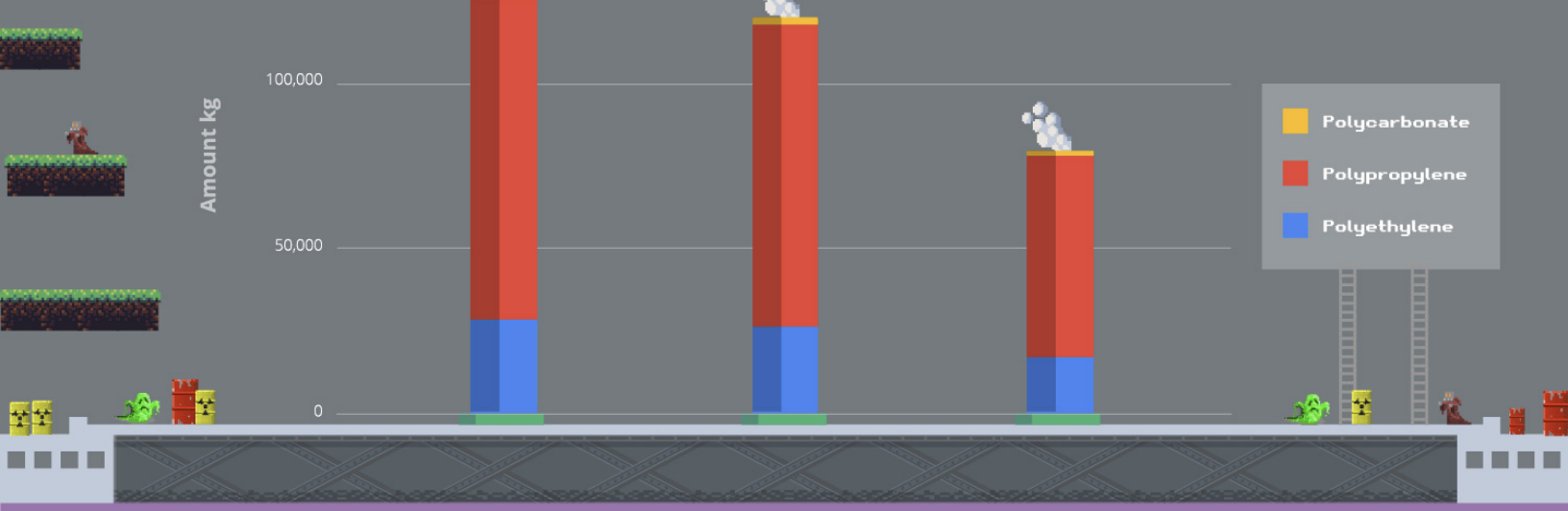
TOTAL CO2 EMISSIONS FOOTPRINT KG
221,540

PLAYING TIME

Comparing the average completion time of popular games against their CO2 Emissions footprint reveals that **Assassin's Creed Odyssey is the most environmentally damaging game to complete**.

PLASTIC WASTE

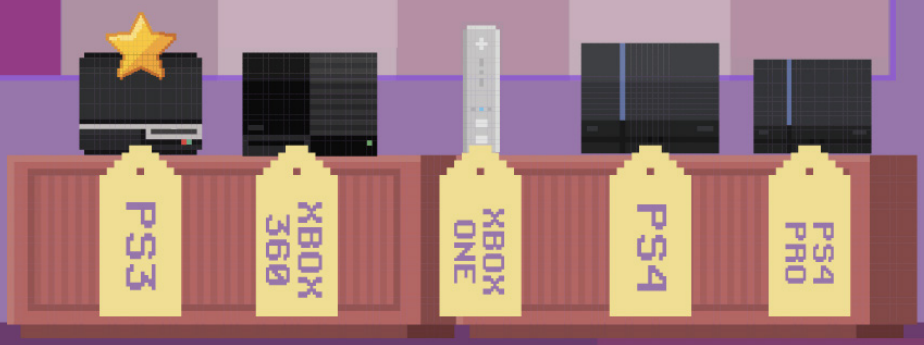
Measuring game sales against the packaging used reveals that **128,479kg of plastic could go to landfill if FIFA 19 players threw their old games away** when buying FIFA 20.

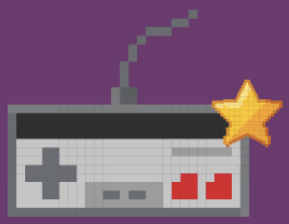


CONSOLE COMPARISON

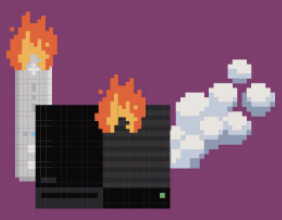
Based on the CO2 emissions resulting from power usage,**the PS3 Original is the least eco-friendly console.**

	PS3	XBOX 360	XBOX ONE	PS4	PS4 PRO
Average Power Usage (Watts)	190	180	122.5	120	117.5
kWh	0.19	0.18	0.1225	0.12	0.1175
CO2e kg per hour	0.054	0.051	0.035	0.034	0.033





Nintendo consoles are the most environmentally friendly, with average



Xbox consoles are the worst for the environment, with average emissions of 0.031kg p/h.

emissions of 0.008kg p/h.

UPCOMING RELEASES

A substantial portion of consoles' energy use is determined by graphics processing.

Based on that alone, the **PS5 could be the eco-friendliest PlayStation since the Classic.**

PS5

1.5x performance-per-watt compared to earlier Graphic Processing Units (GPUs)

Estimated CO2 Emissions per hour

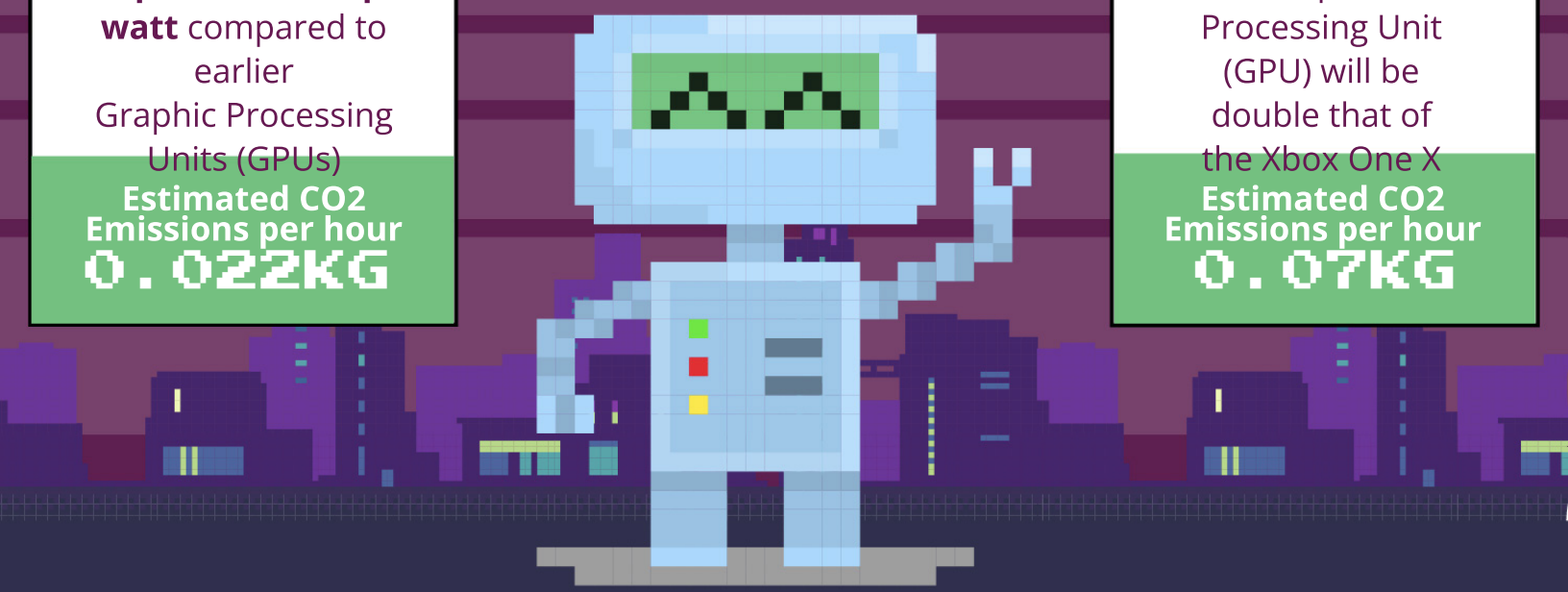
0.022KG

XBOX SERIES X

Graphic Processing Unit (GPU) will be double that of the Xbox One X

Estimated CO2 Emissions per hour

0.07KG



Note: Digital download figures based on 83% of all video game sales being digital in 2018.

Sources: Data gathered from a range of sources, including the energy use calculator, Forbes and National Geographic.

Console Carbon Footprint was conducted by **online slots** specialists Slots Online Canada and used a number of sources such as National Geographic, Huffington Post and The Energy Saving Trust to conduct the research.

Back to the top

THE VERGE

Civilization VI: Gathering Storm.

GAMING

THE MANY WAYS VIDEO GAME DEVELOPMENT IMPACTS THE CLIMATE CRISIS

As environmental breakdown intensifies, the games industry needs to ask itself tough questions

By Lewis Gordon | May 5, 2020, 11:30am EDT

Since the beginning of 2020, the COVID-19 pandemic has overtaken the climate crisis as the most pressing existential threat for much of the world's population. As we adapt to isolation, the warming planet has taken an understandable back seat in the news coverage, although scientists have noted the spread of the novel coronavirus instigating a fall in carbon emissions. But there's a potential dark side to the virus-related reduction as China and countries across the globe seek to make up lost ground. Far from halting the climate crisis, coronavirus might just temporarily pause our emissions, albeit at different times and rates across the world. Once we get through this (whatever that ultimately looks like), its most alarming facts will still

ring true: we only have 10 years to prevent catastrophic overheating while our destruction of entire species continues unabated.

Video games might not appear inextricably tied to the climate crisis, but they are. There's the electricity use of gaming devices themselves, estimated to sit at 34 terawatt-hours of energy each year, or the equivalent of 5 million cars. Once you start unraveling where else the industry intersects with environmental issues, it can be difficult to stop — from the petroleum-based substances the hardware is made of, the workers mining raw materials in already sweltering conditions, to the millions of air miles underpinning business deals. Even just a cursory peek into the future shows the internet infrastructure games are reliant upon might be submerged by rising sea levels. As the crisis rolls on, game makers are beginning to give serious thought to how they might reduce their industry's contributions to the crisis.

COVID-19 has thrown one aspect of the games business into sharp relief: industry conferences. Buoyed on by business and promotional opportunities, thousands of game makers would usually be taking long-haul flights across the globe right now. Except, this year, they aren't. In the United States, GDC and E3 have either been postponed or canceled, the UK's EGX Rezzed is on hold, while in Germany, gamesweekberlin is off for the foreseeable future, with more announcements predicted over the coming months. The effect this will have on the games industry is unclear, but it's already impacting the carbon footprint of game developers. With restrictions on travel, event organizers have been forced to think creatively about how aspects of their conferences might be carried out digitally. GDC broadcast some of its talks online via Twitch and is making its summer event online-only, London Games Festival is taking place digitally, while Steam hosted a new indie festival made up of game demos for upcoming titles. Meanwhile, the new Summer Game Fest will feature an E3-like smattering of product announcements, only in an online format.

In 2019, Rami Ismail, co-founder of the independent studio Vlambeer, established the digital conference gamedev.world. The event started from the perspective that "everyone should have access to knowledge" at a moment when travel restrictions, at least in the US, were at their most stringent (pre-COVID-19). Considering the environmental benefits of a remote event, Ismail says these "rolled" naturally into a broader conversation. While virtual conferences can't yet replace face-to-face networking, gains are made elsewhere, namely in the removal of often prohibitive barriers to entry such as expensive flights and accommodation. If, following the global pandemic, developers opt for a greater emphasis on virtual events, the upside might not just be a reduction in carbon emissions but a more diverse and equitable games industry, one whose perspective is less oriented toward major epicenters such as San Francisco and Tokyo.

Ismail, arguably one of the games industry's most visible presences at physical conferences across the world, notes the global demands of his job (which often centers on advocacy for regional games industries) while acknowledging how his own behavior has

changed over recent years. “I’ve been trying to minimize how much I use aeroplanes,” he says, explaining how he “bundles” travel to particular regions. “If I have a flight to China, I can hop over to Indonesia or Japan. But I won’t do Los Angeles to Japan or New York to Shanghai.” Global journeys of this kind also take place within an environment in which often it’s all too easy to forget the activity’s harmful impacts. “It does a number on your body,” Ismail continues. “But it’s strange how painless travel has gotten.”

Horizon Zero Dawn

While there’s good will toward digital conferences such as gamedev.world, and many game developers acknowledge the negative impacts of frequent flying, hard data on either aviation within game development or the industry’s broader environmental impact is limited. This is exactly what Ben Abraham, a lecturer at the University of Technology Sydney and author of the upcoming book *Digital Games After Climate Change*, has been trying to ascertain with his own research (game makers can help by completing this survey). While he can make best guesses about the carbon impact of the video game players, including distribution, game development is still under-researched.

“One of the goals is to be able to produce a guide or best practice around carbon neutral game development,” he says. “What does that look like? How do you do that? What kind of changes do you need to make to your development structures.” Abraham’s research aims to gain information about participants’ attitudes toward the climate crisis, environmental workplace initiatives, and, perhaps most importantly, the actual electricity usage of organizations.

"WHEN IT BECOMES A GOOD THING THAT PEOPLE CAN PROMOTE, MORE STUDIOS WILL DO THAT."

Space Ape Games, a London-based studio with approximately 120 employees, has already begun to assess and reduce its own carbon footprint, spearheaded by a self-appointed "green team" involving head of content Deborah Mensah-Bonsu, CEO John Earner, and head of technical operations. A page on the organization's website details its emissions; 177.6 tons for flights, 47.8 tons on commutes, 51.9 tons on office device purchases, and a mammoth 376.8 tons on the company's cloud data usage which powers its iOS and Android titles. The studio footprint doesn't include the energy use of the devices its 150 employees use during the workday, but these are powered by the renewable energy provided by building management. Importantly, Space Apes' green policy accounts for the carbon emissions of its players simply because "it was the right thing to do," according to Mensah-Bonsu.

Despite the company's commendable work, which involves workshops with other studios that also want to reduce their carbon footprint, its achievements come with caveats. Space Ape bills itself as carbon negative, but this is achieved partly through carbon offsetting, the theory being that while it's still responsible for pumping hundreds of tons of carbon into the atmosphere, this can be rebalanced by investing in environment-adjacent initiatives. Mensah-Bonsu admits this isn't perfect, but the organization has committed to reducing its carbon footprint in real terms by 10 percent in 2020 as part of the United Nations-backed Playing For The Planet initiative.

Cloud computing, which makes up almost half of Space Ape's entire carbon footprint, is dependent on a service provider Mensah-Bonsu says helps power many other organizations within the games industry. While commitments have been made regarding renewable energy, Space Ape hasn't yet seen the results. "We're trying to put pressure on our cloud computing provider so those changes will trickle down not just to us but to the rest of the industry," she says. "If they come too slowly then I think we're open to moving our workload somewhere else."

The Playing For The Planet initiative Space Ape voluntarily signed up to includes many of the industry's most recognizable names such as Sony and Google (although Nintendo is notably absent). Amid the bullet point list of commitments, Microsoft offers arguably the most robust action, including the "expansion of its existing operational commitment to carbon neutrality into its devices and gaming work." Yet in January 2020, Microsoft sponsored the International Petroleum Technology Conference, a major focus of which was the development of new technologies to aid fossil fuel extraction. For the game makers keen to lessen their environmental impact, Microsoft's inconsistent actions might provoke reasonable questions regarding the actual effectiveness of their — by comparison — negligible emissions.

While Playing For The Planet makes notable gains elsewhere in securing public commitments, the pledges appear notably scattershot. Speaking to *Kotaku*, Gary Cook,

author of the Greenpeace Guide to Greener Electronics report, said: “the actions they’re taking here, for the most part, are not going to move the needle and are not reflective of the significant impact the gaming industry has on the environment.”

Beyond Blue

Regardless of its long-term effects, Playing For The Planet is symptomatic of an industry that increasingly views environmental responsibility as an asset, a point noted by Ismail. “They’re being loud because it’s marketable,” he says. “When it becomes a good thing that people can promote, more studios will do that.”

But waiting for environmental responsibility to become a promotional checkbox implies that the climate crisis might be averted through existing economic structures. It’s worth remembering that hardware manufacturers continue to operate within a framework of planned obsolescence. “It’s great that they’re getting producer and manufacturer buy-in because oftentimes a lot of the environmental rhetoric is focused on the individual level,” says Alenda Y. Chang, professor of film and media studies at the University of California, Santa Barbara, and author of *Playing Nature: Ecology in Video Games*. “But there’s no questioning of having to replace your PlayStation every few years.” In the immediate future, Sony and Microsoft will release their respective new consoles, each of which is underpinned by eye-watering technical specifications whose environmental impacts are far from clear.

Actually running games also comes with an ecological cost, according to Jonathan Koomey, a computer scientist and researcher who has investigated both the energy use of consoles and carbon footprint of games distribution. The power use of consoles and PCs is dictated not only by the level of graphical fidelity but also a game’s structure and action. “If

you choose path one versus path two, that can have an effect," he says. "It's not like a refrigerator [which] you can put in a room at a certain temperature and have a pretty good idea of what will happen."

"THE HIGHER HANGING FRUITS ARE EXPONENTIALLY MORE DIFFICULT TO REACH."

For the most part, designers have sought to expand the ways we interact with increasingly detailed and vast game environments. Open worlds, arguably the de facto choice for major game studios looking for their next hit, are predicated on exactly this approach. Over the past decade, these games have begun to incorporate robust online multiplayer components meaning they're "always on," both in consoles and data centers across the globe.

Free-to-play titles are usually backed by similarly resource-intensive online infrastructure and design principles that seek to maximize player attention and engagement. The more time players spend in such games, the more likely they are to part with their cash through microtransactions. Chang asks the reasonable question: "What if playing for the planet meant playing less or playing differently?" The question could be extended to game makers and studios. If the carbon footprint of games were measured, and each title was required to be at least carbon neutral, we might begin to see both new design possibilities and infrastructural sustainability taken more seriously.

Carbon neutral or even negative games might still be wishful thinking, but studios and game makers can take other steps toward environmental sustainability. Koomey, whose research has also explored energy-efficient software, believes studios may need to be more proactive to ensure their games, and the consoles they run on, use as little energy as possible. Since 2000, gains in energy efficiency have slowed as computational power has risen. He says that while game consoles are already designed to be more efficient than general purpose computing devices, this shouldn't mean designers and programmers should shy away from further optimizing their games.

Minecraft | Image: Microsoft / Nvidia

Optimization tends to be associated with achieving target frame rates such as 30 or 60 frames per second. Game engines generally come with extensive performance profiling which tracks how hard CPU and GPUs are working. Designer and activist Hugo Bille believes these demands likely correspond to energy use, but, for the time being, such tools aren't framed around a question of energy sustainability but achieving the much-vaunted target of 30fps. "I've never come across any thought of optimizing code beyond what's required to meet our target framework," says Bille, referring to his time developing console games such as *Fe*. "In most cases, you've already worked really hard to get the game running at 30 fps. A lot of the time, the higher hanging fruits are exponentially more difficult to reach."

Still, Bille, who also founded the environment-focused Game Devs For Future discord channel, says in-engine systems might be a useful place to start educating game makers on the energy intensity of their software. "I could imagine profiling tools better highlighting opportunities for low-intensity play, nudging developers to aim higher than their target fps."

The International Game Developers Association (IGDA) Climate Special Interest Group is already looking to "develop and advocate for power-saving software design patterns for video games." According to Erin Hoffman-John, head of the creative team for Google Stadia's research and development, the Climate SIG will "document what developers are already doing, consolidate resources to make best practices more accessible, and help connect communities of developers interested in this kind of work." The Google Stadia team is also exploring a new Sustainable Game Development Guide as well as research into "green nudges," the latter described by Hoffman-John as "early science" but which its advocates hope will shape consumer behavior.

Google's aims might be laudable, including a robust commitment to renewable energy, but the company, like Microsoft, is plagued by contradictions. It funds climate change deniers and recently established a new group to court the oil and gas industry.

NATURE DOESN'T CARE WHETHER WE'RE PLAYING THOUGHTFUL ECOLOGICAL ADVENTURES OR THE NEXT HIGH-TECH MILITARY SHOOTER

Perhaps the most obvious way game makers might tackle the climate crisis is through the games themselves. Historically, few games have even bothered with the issue let alone effectively tackled it. *Civilization 1* and *2* featured a global warming mechanic, but the series didn't broach the subject head on until 2019's *Civilization VI: Gathering Storm* expansion. In the last five years, educational games such as *Eco* and the *Minecraft* mod "Global Warming" have sought to use the medium to deepen a younger audience's awareness of the issue. In blockbuster titles, environmental anxiety occasionally bubbles to the surface, as it did in *Anthem*'s geoengineered landscapes and *Horizon Zero Dawn*'s lush biosphere, but indie titles such as *Bee Simulator* and the upcoming *Beyond Blue* are, perhaps unsurprisingly, exploring the issue more explicitly. Art games such as *Oikospiel*, *Even in Arcadia*, and *Utopias* arguably offer the most confrontational work, channeling the issue's urgency in uncompromising style.

As game worlds have become richer, their capacity to tell compelling environmental narratives has increased. These stories will only become more resonant in the coming decades. But as for their utility beyond storytelling, Abraham is skeptical of their capacity to alter behavior or foster newly ecological minds. "I think the value in the idea of promoting things through design is really limited," he says. "Particularly when it comes to issues that are ideological or routed in a person's political background, their history, and their upbringing."

Ultimately, nature doesn't care whether we're playing thoughtful ecological adventures or the next high-tech military shooter. There are more concrete areas game makers can focus their efforts, like switching to renewable energy and considering the performance intensity of their games. If studios want to put pressure on industries' biggest companies, including the hardware manufacturers and major service providers, collective organization might offer not only the best shot at being heard but also of enacting substantive change. As for one potential area of focus, supply chains are still woefully invisible for the most part. Greater transparency might enable a better chance of not only lessening hardware's environmental impact but also improving the allegedly backbreaking work conditions in developing nations that continue to prop up the industry.

These are big challenges to overcome, particularly within a development industry so dependent on keeping console and store platforms in good favor. But as the clock ticks on, there is little else to do but try. ■