

#### STATES OF MEDIA+ENVIRONMENT

# Streaming Media's Environmental Impact

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This group of articles, which arose from a panel planned for the 2020 annual meeting of members of the Society for Cinema and Media Studies, draws attention to an unpopular but inescapable issue: the adverse environmental effects of streaming media. Four of these brief interventions focus on streaming media's carbon footprint, estimated by some to be 1 percent of global greenhouse gas emissions (The Shift Project 2019). This startling figure is rising at a calamitous rate as more people around the world stream more media at higher bandwidth—now exacerbated by the COVID-19 pandemic. Another factor in streaming media's environmental impact is even less welcome: the deleterious effects of higher levels of electromagnetic frequencies that media corporations' turn to fifth-generation (5G) wireless technology would exacerbate. These effects are well documented yet almost universally ignored. Despite all these findings, the notion abides that digital media are immaterial. Laura U. Marks introduces the research challenges involved in calculating the carbon footprint of streaming media and suggests actions consumers and media makers can take to mitigate this environmental threat. Joseph Clark discusses the implications of digitizing huge amounts of archival film and connects material histories of news film production, distribution, and preservation or disposal to contemporary issues of digital storage, streaming, and energy use, using the newsreel archive as a case study. Jason Livingston's contribution expands on his droll and disturbing video lecture, which presents a speculative app for mobile phones that tracks streaming, correlates it to energy use and CO<sub>2</sub> emissions, and suggests methods to mitigate usage. Denise Oleksijczuk introduces scientific research on the health and environmental impacts of high levels of electromagnetic frequencies and suggests ways, including creative practice, to break through the resistance to these findings among telecommunications companies, governments, and the public. Lucas Hilderbrand focuses on best practices in teaching: how to educate our students about these impacts, and how teachers can resist increasing pressures to use streaming-based pedagogical media. Many communities around the world already rely on low-tech media, of necessity, and are often extremely innovative in their use (Marks 2017). However, network and media corporations are aggressively marketing devices and streaming platforms in both "developed" and "developing"

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regions (Cisco 2020). Many of the latter regions depend on fossil fuels and cannot afford to prioritize renewable energy and efficient systems. Thus streaming media's carbon footprint is not just a First World problem.

Media+Environment Blog Update from Laura Marks: <u>https://mediaenviron.org/post/1116-a-survey-of-ict-</u> engineering-research-confirms-streaming-media-s-carbonfootprint-by-laura-u-marks

## Calculating and Mitigating Our Streaming Carbon Footprint

Laura U. Marks

Most research and activism intended to slow global warming focuses on sectors known to have significant greenhouse gas emissions (GHG), such as road transportation (estimated at 11.9 percent of global GHG in 2016), heating residential buildings (10.9 percent), air transportation (1.9 percent), and agricultural livestock (5.8 percent, mostly due to methane gas) (Ge and Friedrich 2020). We environmentalist media scholars need to pay attention to the greenhouse gas emissions resulting from streaming video.

Despite corporate-led hopes that information and communications technologies (ICT) will lead to greater energy efficiency in other areas (GeSI 2015), these efficiencies may be outweighed by the rising electricity consumption of ICT themselves (Lange, Pohl, and Santarius 2020). That consumption, driven by data servers, networks, and consumer devices, currently emits 2.7–3.3 percent of global greenhouse gases (Belkhir and Elmeligi 2018; Lorincz, Capone, and Wu 2019) and is cautiously projected to comprise 7 percent of global greenhouse emissions in 2030 and 15 percent in 2040 (Belkhir and Elmeligi 2018).<sup>1</sup> Streaming media contributes more than any other sector to this increase (Cisco 2020).

Driving this exponential rise is video, as more people around the world stream at higher bandwidth for longer periods. Research on ICT suggests that streaming media will constitute 74 percent of mobile data traffic in 2024 (Alsharif et al. 2019). As well as increased smartphone use, high-definition (HD) video is feeding this surge. The bit rate for streaming 4K video, 15–18 megabits per second, is more than double the HD video bit rate and nine times more than that of standard-definition (SD) video. Even the most industryfriendly study notes, "Broadband-speed improvements result in increased consumption and use of high-bandwidth content and applications" (Cisco 2020, 15). This is the Jevons paradox: more efficient technologies often encourage greater use of a resource, reducing or eliminating savings.

<sup>1</sup> Other projections put this figure for 2030 at as little as 1.97 percent (GeSi 2015) and as much as 21 percent (Andrae and Edler 2015).

I am working with IT engineers Stephen Makonin and Alejandro Rodriguez-Silva to survey research in IT engineering and translate the technical language into accessible terms. Reading this literature, I have the impression that the industry is outsourcing the unsustainable demand for more bandwidth to engineering miracles, logarithmic tweaking, and 5G fever dreams (see Denise Oleksijczuk's contribution).

Calculating the environmental impact of streaming video requires identifying the energy source at each point, from data centers to end user. While this varies greatly among countries and regions, currently about 80 percent of global electricity is generated from fossil fuels (World Bank 2014; The Shift Project 2019).

The environmental impact of streaming video is difficult to estimate, for one thing, because it is distributed across many sources. IT engineers begin by defining a system boundary that includes some or all of the following: data centers, undersea cable, IP core networks, access networks, home networks, and user devices (phones, computers, televisions). They rarely include the energy expended in producing and disposing of all those devices and hardware. Their methods vary greatly. Thus, calculating the energy usage of internet data transmission depends on what premises you accept.

*Electricity intensity* is the amount of electricity in kilowatt-hours required to transmit a gigabyte of data. In a survey of fourteen studies of the electricity intensity of internet data transmission (Aslan et al. 2017), the two most recent studies that include data centers and whose methodologies the survey's authors approve of cite the following figures:

2.64 kWh/GB (Malmodin and Lundén 2018)

7.34 kWh/GB (Krug, Shackleton, and Saffre 2014)

Average: 4.91 kWh/GB

Malmodin and Lundén's study is based on data from Sweden for several years up to 2010, Krug, Shackleton, and Saffre's on data from the United Kingdom up to 2012, and both on "legacy" or older networks. Electricity intensity will have improved since 2012, but not exponentially. Moore's Law (that the capacity of a microchip doubles every eighteen months to two years) doesn't apply, because we are talking about not only computing efficiency but also electrical efficiency, which is expected to be 10 percent at best (Andrae and Corcoran 2013) and is projected to plateau and then rise again in the mid-2020s (Koomey and Naffziger 2015). Furthermore, cooling, power supply, and storage are subject to physical constraints, and, as my colleague Makonin explains, companies are slow to update legacy networks because of the expense.

#### See corrected Table 1: https://doi.org/10.1525/001c.21985

Table 1: Calculating the carbon footprint of a given streaming program

Length of the streaming video in hours × GB per hour for a given resolution (Summerson 2018) 480 pixels: ~792 MB/hour 720p: ~1.3 GB/hour 1080p: ~1.9-2.55 GB/hour 1440p: ~2.8 GB/hour 4K: ~3.5-7 GB/hour × x energy intensity: 4.91 kWh/GB × number of unique viewers × 0.007 metric tons of CO<sub>2</sub> (Environmental Protection Agency 2020) = carbon footprint

Once you have determined the amount of electricity used in a given video streaming, you can use the US Environmental Protection Agency's <u>Greenhouse Gas Equivalencies Calculator</u> (2020), which calculates the amount of greenhouse gas generated, given the EPA's estimate of the amount of electricity in the United States that comes from fossil fuels.

Media scholars can use the rough calculator Makonin, Rodriguez-Silva, and I devised for the carbon footprint of a given streaming program (see Table 1).<sup>2</sup> (Because it's based on older figures, it's a bit high, but not exponentially. We are working to develop a more accurate calculator.)<sup>3</sup> For example, I stream thirty-five hours of video a month to my computer at 1080-pixel resolution. The energy that this requires is 382.36 kWh. According to the EPA calculator, that's 2.68 metric tons of CO<sub>2</sub>. It's equivalent to the CO<sub>2</sub> emissions from 30.4 gallons of gas consumed by a vehicle, or the carbon sequestered by 4.5 tree seedlings grown for ten years.

Media consumers can mitigate their carbon footprint in the following ways:

- Stream less. As in the French axiom "Boire moins, boire mieux" (drink less, drink better), we can be more selective about our viewing and train ourselves not to click on the link, to stop the automatic download, to purchase the digital album rather than streaming it (good for the environment, and good for the artist too).
- Use physical media. Given the fragility of DVDs, I am hoping it becomes more common to circulate media files on a more durable medium like USB drives.

<sup>2</sup> Summerson uses Netflix's streaming bit rate. Netflix is more energy efficient than other platforms.

<sup>3</sup> The French think tank <u>The Shift Project</u> provides a carbon calculator based on file size, not program length, which is based on the high projections of Andrae and Edler (2015), but underestimates other factors.

- If safety during the pandemic permits, put on a mask and go to the movies.
- Watch TV!
- Consider high-resolution video a luxury for special occasions—like another greenhouse-gas guilty pleasure, steak.
- Resist the temptation of immediacy. I love to watch films on MUBI. However, many of them are available at the video store or the public library, if I'm willing to wait a couple of days.
- Pay carbon offsets for streaming, as we do for air travel.
- Lobby our governments to require that internet service providers build carbon taxes into their business model.
- Turn off the HD option on our phones' cameras.
- Resist obsolescence and hang onto our phones for as long as possible.

Media makers can do the following:

- Produce works in versions: one for live screening or installation, another for streaming.
- Make small-file media! At the Small File Media Festival (https://smallfile.ca/), in Vancouver, we accept movies no larger than five megabytes, which stream online with minimal carbon output. Small-file movies are thrillingly inventive, delicious morsels. If their fuzziness and brevity leave us dissatisfied, that's more reason to urge our governments to speed the conversion to renewable energy.

## Material Pasts and Futures in the Newsreel Archive

Joseph Clark

Archival research in film and media studies has undergone a profound shift over the last twenty years as digitization and streaming video have made all kinds of moving images far more accessible. In the fields of nontheatrical and ephemeral film history, in particular, digital distribution of archival material has made new research possible and helped to transform our understanding of film cultures. In my contribution to this collective essay, I will reflect on my own experience researching and teaching with archival film in order to weigh the costs as well as the benefits of streaming video.

The recent publication of my book on the history of the newsreel in the United States marks the culmination of a project started for my dissertation more than fifteen years ago (Clark 2020). When I did the bulk of the archival research that forms the basis of the book, it meant traveling to places like Los Angeles, Washington, DC, and Columbia, South Carolina, to see copies of rare newsfilms and outtake footage. Usually these were film or videotape reference copies transferred from the original nitrate film and stored in temperaturecontrolled vaults.

The sheer magnitude of the newsreel archive and the preservation challenges it poses are staggering. To take just one example, the Fox Movietone Collection at the Moving Image Research Collections (MIRC) of the University of South Carolina includes almost eleven million feet of original archival film. This is only a fraction of the Fox newsreel archive that was originally slated to be donated to USC—a total of more than seventy-five million feet of film (Wilsbacher 2018, 233). Fox News, which began in 1919 and ran until 1963, was just one of five major studio newsreels in the United States during the 1920s–1950s.

Doing my archival research took time, money, and energy: I had to fly to the city to visit the archives, the archives needed to keep the film in climatecontrolled conditions, et cetera. Crucially, the costs to me and to the archives were tangible and relatively visible to all involved.

Digitization has changed things. Today, a wealth of newsreel footage is now available online (with more slated to become available in the next couple of years). This material is available on the websites of the archives themselves—like the Digital Video Repository MIRC at (https://digital.library.sc.edu/departments/mirc/)-or on websites like the Internet Archive (archive.org). Like other newsreel archives, MIRC is in the process of digitizing its collection. Currently it makes low-resolution videos made from its old VHS reference collection available online. These copies are relatively small files at only 70 MB for about ten minutes of newsfilm, but highresolution scans of the same footage made from film prints can be 500 MB or more.

These new platforms are a huge benefit for scholars doing research like mine. Hours of rare footage are now available online to be studied and used in the classroom. Indeed, this accessibility has been critical in incorporating important new research in nontheatrical film into my teaching. But while these digital archives make accessing historical film much easier, like all streaming video platforms they also make it very difficult to know the cost involved in using them. One of the challenges of our digital world is that once tangible and transparent experiences are now opaque to us. The financial and energy costs of streaming archival video are largely invisible to its users. As Greg Wilsbacher, curator of newsfilm at MIRC, explained in an email to the author, MIRC's "data is measured in the hundreds of terabytes, which is stored on physical servers and in the cloud. Both methods cost more money than researchers imagine and these costs are recurring... not one-time costs" (Wilsbacher 2020). While MIRC must cope with the ongoing financial burden of digitization, it is time researchers and other users of streaming video considered the environmental costs as well.<sup>4</sup>

For my own work, I wanted to understand how much energy it takes, for example, to stream a newsreel. As Laura Marks discusses above, measuring the energy costs of streaming video is a challenge. Although many differing estimates exist, the electricity intensity of 4.91 kWh per gigabyte of data that Marks arrives at is close to the 5 kWh per GB figure calculated by David Costenaro and Anthony Duer in a report prepared for the American Council for an Energy-Efficient Economy. That includes the energy used to store the data (48 percent of the energy used per GB of streaming video), to transfer it over the web (14 percent), and for me to download or stream it on my laptop (38 percent) (Costenaro and Duer 2012, 65). Using this approximation, I found that streaming a high-resolution copy of a ten-minute newsreel (500 MB) is about 2.5 kWh. That, according to the owner's manual for my clothes dryer, is about the equivalent of drying one load of laundry. This is an equivalence that I found instructive. Like many, I try to avoid using my dryer—I hang most of my laundry in order to save energy. If I am willing to make the choice to not use my dryer out of my concern for energy use, I should be able to make the same calculation when it comes to streaming media. Indeed, since doing these calculations and making this energy use more visible, I found myself thinking more carefully about how I use streaming media in my research and especially in my teaching. The discussion of best practices in Lucas Hilderbrand's "Cinema and Media Pedagogy in the Streaming Era" is an excellent place to start.

Unfortunately, individual choices are not sufficient to address the environmental costs of streaming media. These problems won't be solved by individual action—but by collective ones taken by government and industry. However, as a society—and as archivists, researchers, and teachers—we won't be able to understand the worth of streaming video unless we also understand the cost, and that includes the energy cost. The first step to collective action will be to make these costs visible.

## A Speculative App for Monitoring and Visualizing Streaming's Carbon Footprint

### Jason Livingston

For our reconstituted Society for Cinema and Media Studies panel on media streaming, I created a performative lecture <u>version</u> of my talk. The video contains exported PowerPoint slides embedded in arctic imagery and is bookended by a polar bear who offers remarks in my absence.

<sup>4</sup> For more on the environmental costs of archival digitization, see Linda Tadic's excellent presentation at the 2020 Orphans Film Symposium (Tadic 2020).

What is media streaming? Where does it begin, and where does it end? Here we face intertwined technical and conceptual questions. I propose developing an app that would track an individual's streaming carbon footprint. Streaming isn't categorically different in terms of a carbon footprint, but a smartphone application affords opportunities for interactivity that a laptop program or plug-in may not. Targeting the specifics of smartphone streaming presents software challenges. Nonetheless, it should be possible to identify streaming times and data transfer quantities, and to translate those into energy consumption and thus into IRL consequences. The Shift Project's <u>"Carbonalyser"</u> represents one such step in this direction.

The word *speculative* plays an important role in my presentation. The reasons are twofold. First, I approach the app as a media artist who for two decades has mostly produced single-channel works; coding and software engineering thus represent new practices. The Twitterbot @BearLife2020, the Arduino/ website *Goodbye, World!*, and invocation of a charismatic megafauna polar bear through Snapchat filters all constitute speculative sketches toward an eventual mobile application.<sup>5</sup> In something of a cruel but potentially effective modeling of reinforcement, the app would present animated star species thriving or suffering based on energy consumption. Second, the language of speculation allows us to think differently about our footprints, how we walk in the world. In this way, the app falls in the lineage of other speculative artists who gesture toward what is possible through process and proposal.

As to whether it is *realistic* to decarbonize through a demand to decomputerize, I suspect the answer is no, but as is often the case, the practical here functions to limit our imaginations. As most metrics predict, we are on track to consume exponentially more media on our phones and computers. Amazon Web Services created over half of the company's revenue in 2018. The data industry is committed to not only selling more consumer goods and producing content to stream but also storing that data in energy-intensive structures around the world. "Greening" data infrastructure cannot fully address the consumption problems baked into computer use.

These questions are designed to supplement the important work of reducing the impact of media streaming where we can, whether that be at home, in our hands, or in our classrooms.

# Remediating the Senses: A Curiosity Cabinet for Our Times

Denise Oleksijczuk

As the other essays in this collection make clear, streaming media wastes a tremendous amount of energy. Hardwired connections are many thousands of times more energy-efficient than streaming data wirelessly through the air

<sup>5</sup> For additional context see: <u>https://www.jasonlivingston.net/gifs-tumblrs-fragments-cast/</u>



Figure 1: Catherine Richards, *Cabinet of Curiosities at the End of the Millennium*, 1995. Photograph courtesy of the artist.

(Makonin 2020). To account for the health effects of these measurable, artificial electromagnetic radio frequencies, which lie below the threshold of human perception, I turn to an artwork that marked the advent of widespread cell phone and internet use. The work opens up the controversial issue of the connection between wireless radiation and adverse health effects on humans and other animals and plants.

Catherine Richards's *Cabinet of Curiosities at the End of the Millennium*, 1995 (Figure 1), commissioned by the Gemeentemuseum in Arnhem, the Netherlands, consists of a large, transparent display case set on a stand. The copper mesh wrapped around the cabinet's mahogany wood frame shimmers in the daylight. Three steps lead to two front doors, which open onto an empty space, save for a wooden seat. When closed, the copper enclosure creates a Faraday cage, which blocks out artificial electromagnetic fields from the interior. A hefty grounding cable attached to the back snakes along the floor, circling the window guard before plunging a long way down and then disappearing into the earth (Figure 2).

Richards's work creates a new function for the curiosity cabinet, which traditionally displayed private collections of wonders from home and abroad. When the doors are closed, it becomes a quiet zone, separate from the sea of artificial radiofrequency (RF) emissions raging outside. Whenever intrepid spectators put themselves on display inside *Cabinet of Curiosities*, a



Figure 2: Richards, Cabinet of Curiosities at the End of the Millennium, detail. Photograph courtesy of the artist.

participatory work, the digitally disconnected human being becomes an object of contemplation (or, perhaps, ridicule, as in the television series *Better Call Saul*).

Today, DIY Faraday cages are being used to protect the increasing numbers of people who suffer from electrohypersensitivity, or EHS (see Mukherjee 2020). EHS is an illness attributed to exposure to wireless or RF radiation, a form of electromagnetic radiation that ranges from 30 kHz to 300 GHz. Common symptoms are headache, fatigue, difficulty concentrating, skin rashes, and tinnitus. While Sweden recognizes EHS as a functional disability, which implies that only the environment is the cause, in most countries doctors are baffled by their patients' symptoms.

In 2011 the International Agency for Research on Cancer (IARC) classed RF radiation as a possible human carcinogen. Based on the results of the US National Toxicology Program's ten-year study of the biological effects of cell phone radiation (Smith-Roe et al. 2020), bioengineer James C. Lin is one of the many scientists calling on the IARC to upgrade this classification to an even higher level (Miller et al. 2019). In his 2013 study, Martin Pall observed that long-term exposure to nonionizing frequencies increases calcium inside

the cell, allowing excessive amounts to pass into the mitochondria, which leads to a reduced ability to generate adenosine triphosphate (ATP) and increased oxidative stress. This damage at the cellular level extends beyond humans, affecting insects and plants as well (Lázaro, Chroni, Tscheulin et al. 2016 2016).

The majority of the world's countries rely on safety guidelines formulated by the International Commission on Non-Ionizing Radiation Protection (ICNIRP). ICNIRP relies solely on the evaluation of short-term thermal (heating) effects from RF radiation, thereby excluding decades of published science demonstrating the adverse effects caused by nonthermal radiation (Hardell and Nyberg 2020, 247). But doesn't using only one type of measurement strike you as odd, especially given that humans are now expected to live with chronic exposure to RF radiation from multiple antennae from the cradle to the grave? In 2017 hundreds of scientists and doctors signed an appeal to the European Union asking for a moratorium on the installation of 5G wireless until it has been tested for safety by independent scientists (Hardell and Nyberg 2020). According to Lennart Hardell, professor at Örebro University Hospital in Sweden, "The responses from the EU seem to have thus far prioritized industry profits to the detriment of human health and the environment" (2020, 247).

To be sure, the rising numbers of EHS sufferers present an inconvenient obstacle to the telecom industry's rollout of the new millimeter-wave highspeed wireless infrastructure deemed necessary to power the demand for highresolution streaming media, as well as the Internet of Things. Sufferers move to the woods or to the world's quiet zones, such as Green Bank, West Virginia, or EHS Refuge Zone, Drôme, France, where they access the internet via wired Ethernet connections. However, with the launch, already underway, of fifty thousand of SpaceX's Starlink satellites designed to beam high-speed internet service from the sky (Cuthbertson 2020), such spaces of refuge will certainly be eliminated. Public pushback against the flooding of the planet with microwave radiation is surging (for example, see Friedman and Kliparchuk 2015 and the GUARDS coalition website), with more than three hundred groups forming in the United States alone. The deployment of 5G without any local consultation or prior testing is an urgent public health issue, one that has citizen groups, such as the SafeG Alliance, advocating for the use of available infrastructure for fiber optic cables instead. Hardwired connections are faster, more reliable, and more secure; they use far less energy and avoid exposing human and other animals, plants, and microorganisms to electromagnetic frequencies many orders of magnitude higher than those found in nature (Schoechle 2018).

These differing qualities of 5G and hardwired connections matter because "embodied experience through the senses (and their necessary and unnecessary mediations) is how we think" (Jones 2018, 218). When our senses are disrupted by steadily increasing RF emissions, it becomes harder for us to "relearn our

being in [the world]" (Le Guin 2017, M15). "To survive," as Anna Tsing and others advise, "we need to relearn multiple forms of curiosity. Curiosity is an attunement to multispecies entanglement, complexity, and the shimmer all around us" (2017 G11). Richards's curiosity cabinet reveals the danger at the heart of the rapid deployment of new wireless technologies. We must escape into the Faraday cage cabinet to preserve our senses, which are essential to keep us connected to the world's fragile and transient living wonders. By remediating the fabulous human sensorium, *Cabinet of Curiosities* reminds us of our kinship with, and responsibility to, all of the things that "...crawl, and run, and fly" (Macdonald 2014).

## Cinema and Media Pedagogy in the Streaming Era

## Lucas Hilderbrand

All media distribution and viewing platforms have a carbon footprint. Whereas we now are producing—and disposing of—less plastic with the move from VHS and DVD to streaming, streaming both consumes a lot of energy and perpetuates the myth of immateriality. The streaming genie was already out of the bottle. Now, with the COVID-19 pandemic, the quarantine culture of binge streaming and the administrative necessity of online teaching will only entrench streaming practices.

As media scholars, we have limited capacity to influence changing the sourcing for our energy grids or to enhance government regulation of emissions (particularly in places where government leaders reject research-based expertise). What we *can* realistically do—and must do—is educate our students about the impacts of the media they consume. I have found in my own teaching that students are often unaware of the carbon footprint of streaming. (See Glanz 2012 for an assignable article on this topic.) Here I offer a few pedagogical suggestions for first steps—with the hopes of inspiring further best practices.

# 1. Streaming Impact Acknowledgment

One of the easiest and broadest ways to raise awareness of streaming's environmental impact is to include an acknowledgment statement in our syllabi. This would operate much the way land acknowledgments do. I have drafted a rather lengthy one for my current course (taught entirely online with numerous streaming video lectures, clips, and feature films):

Streaming media has a significant carbon footprint due to the high energy usage necessary for data storage on servers, for transmission, and for playback. The scale of emissions depends on both the energy sources (fossil fuels create more impact than renewable ones) and the amount of data streamed (higherdefinition streams use more energy than standard-definition ones, and video requires more energy than audio). Although migration to renewable energy sources has improved, demand for streaming content and bandwidth has accelerated even more. You can reduce your carbon footprint by reducing how much you stream, by reducing the resolution of your playback, by dimming your device, and by lobbying your energy provider and government regulators to switch to renewable energy sources. Broadcast sources (such as radio), tangible media (such as vinyl records and DVDs), and collective viewing (such as in a movie theater) have a lower carbon footprint than everyone individually streaming music and audiovisual media.

The idea here is not just to be accountable for our own courses but also to help students be mindful of their personal media consumption—and ideally, in turn, for them to spread the word. Readers are invited to take up this idea and edit the statement to suit their needs and purposes.

#### 2. Incorporate the Environmental Impact of the Media—Production, Distribution, and Consumption—into Our Curriculum

When we teach media industries, we could incorporate readings about the environmental impact of production (Stine 2018) into the discussion. Likewise, we could interrogate the ways that consumer electronics companies drive planned obsolescence, which produces more e-waste that has toxic implications for both ecosystems and humans (Grossman 2006). We should also address the structures of environmental racism that determine where these discarded technologies end up and the disproportionate impact of climate change upon the populations that are already the most precarious (Guha 1989; Parks 2007; Nixon 2011; Di Chiro 2016; and Yusoff 2018). When we teach formal analysis, we could reflectively interrogate the ideologies behind the drive toward higher-resolution formats and larger screens—technologies that cinema scholars likely unquestioningly value but that also require far more energy. Finally, we could teach critical and creative thinking skills—as well as build next-generation buy-in—by challenging our students to strategize their own solutions for mitigating the media's climate impacts.

# 3. Insist on Screening Times for Collective Class Viewing

When our teaching returns to physical classrooms (and hopefully it will), we will likely need to advocate for returning to scheduled screening times as part of our classes. At my home campus, it has become increasingly difficult to get the registrar to grant my department the necessary classroom time because we are "off module." Several years ago, we already experienced significant cutbacks in screening times for our classes. Now that we are teaching remotely, I am concerned that there will be additional pressure to normalize streaming rather than in-person class screenings. We have long argued that a collective screening experience most closely replicates the historical experience of cinemagoing and that the screening conditions of a projected image on a large screen are essential for attentive viewing and formal analysis. What we might now add to this

argument is that collective screening is also a green practice: the carbon footprint for one in-class screening would be substantially less than that for dozens or even hundreds of students streaming the same media individually on their devices. Perhaps the environmental impact argument will be more efficacious—particularly on campuses with a stated commitment to ecological responsibility—than the older pedagogical ones in protecting our screening times.



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