



Quantifying e-Waste in Corporate IT

Three simple fixes IT can make to prevent their businesses from wasting millions and polluting the environment.



Introduction

Here's something you probably didn't know:

A computer that takes longer than 5 minutes to start, will produce, at a minimum, 450 tons of CO2 emissions per year—or the equivalent of 50,636 gallons of gasoline!¹

Much of the discussion today surrounding climate change and technology focuses on data centers, cloud computing, and big tech companies like Google and Facebook. But what about the billions of devices that are managed by corporate IT departments and the millions of digital workers that logon each day to work?

We identified 3 steps you can make today to reduce your carbon footprint and save money:

1. Easy – Device Performance & Age

During your next hardware refresh, make sure you only replace (and pay) for what you need! About 1/5 of the older devices we analyzed (+3 years old) were in excellent condition. These computers had a fast startup time, high CPU power, and a host of other strong performance metrics.

2. Medium – Device Performance & Startup Time

At first we thought ~80% of the older devices in our study should be replaced with newer hardware. This subgroup recorded an excruciatingly slow startup time (+5 minutes). But upon further analysis, we found that the majority of those computers (98%) could be fixed with a simple RAM upgrade and some configuration changes.

3. Hard – Employee Computing & Software/Internet Usage

We identified several gaming, personal communication, and media streaming apps that generated about 695 Kgs of CO2 emissions per week. We understand that data protection laws and cultural norms make personal computing a tricky subject for most organizations. But we still think IT can do more to educate and inform employees about smarter, more eco-friendly computing habits.

If you work in IT, you might think your role is trivial in the fight against climate change, but it isn't! There is an entire world of positive micro-steps IT can take to reduce its organization's carbon footprint.

Let's get started.

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¹ United States Environmental Protection Agency. Greenhouse Gas Equivalencies Calculator. <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

Data Highlights



450

tons of emissions

Of the 3.5 million computers we analyzed, 34% averaged over 5 minutes to fully load. This wait time equates to about 450 tons of CO2 emissions per year.



20% of old generation devices were perfectly fine and didn't need to be replaced. Sometimes doing nothing is the smartest decision you can take.



Collectively, gaming, personal communication, and media streaming apps generate about **695 Kgs of CO2 emissions per week.**



Media Streaming and Download applications generate up to **350 Kgs of CO2 per week.**

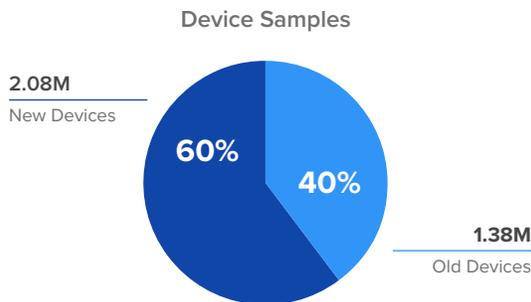
The Case for Green Hardware

Why is IT throwing away perfectly good devices?

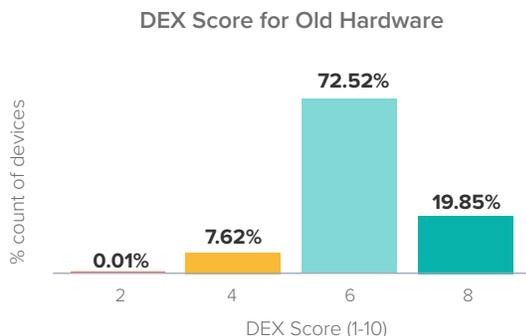
IT departments are under constant pressure to equip employees with the best devices and digital solutions. But to reach that goal they need to make smart financial and environmental decisions based on reliable hardware and digital experience data.

With that in mind, we wanted to find out how many devices on average Corporate IT truly needs to replace. As a general rule of thumb, most tech teams will refresh their company computers every 1 to 3 years².

Knowing this, we took to our sample of 3.5M anonymous devices that were used in the first two to three weeks with Nexthink and organized these devices by new generation computers (-3 years old) and old generation computers (+3 years old). Of the old computers (~1.38M), less than half were desktops (42.42%) and the rest were laptops (57.58%).



Right away we found that ~20% of old devices (~276k) had an optimal Digital Employee Experience (DEX) Score (>8), which meant that these devices reported perfectly healthy performance metrics and a high level of employee satisfaction.



*See page 5 to learn what goes into a DEX Score.



We found that only 2% of older generation devices (+3 years old) should be replaced with new hardware.

² Nexthink Quick Poll. Pulse Research. On Average, how long do you wait to refresh your company's hardware? 124 technology leaders. 53% refresh every 1 - 3 years.

The remaining ~80% of devices recorded a poor DEX Score (<8), but upon further analysis, we found that only 2% of them were truly beyond saving. The remaining 98% (~1.08M) of computers could be fixed with a simple RAM upgrade or by optimizing the device's startup performance. We also found that for the majority of computers, the age of the device didn't matter much for overall performance. Most IT teams will struggle to compare these types of variables because they lack true end-to-end visibility.

Uncovering the Truth - Hardware Ranked by IT Performance

- ✔ **Excellent** - 20% of old devices were perfectly fine and shouldn't be replaced.
- ✔ **Average, but salvageable** – of the remaining devices that had been deemed underperforming, 98% of them were in fact salvageable. IT could fix these computers with a simple RAM upgrade or by optimizing startup performance.
- ✘ **Poor, & should be replaced** - 2% of devices from our study were deemed “unfixable,” and required a hardware refresh. Drilling into this subgroup's DEX Score, we discovered that these devices had consistently poor CPU usage issues and were likely causing employee frustration.



What's a DEX Score?

A Digital Employee Experience (DEX) Score quantifies the ability of an employee (or group of employees) to get things done in their IT environment in a safe and positive manner. It functions like an index calculation by combining the most relevant performance metrics in the digital workplace. Sub-scores can be aggregated from components like the device, business apps, productivity apps, and employee satisfaction ratings.

What's a good DEX Score?

The Nextthink DEX Score is based on a 10-point scale. We ranked the devices in this study under 3 distinct thresholds: 0 – 6 (frustrating), 6 – 8 (average), 8 – 10 (good). Many factors go into a good DEX Score, but typically this means each sub-score is at an optimal level.

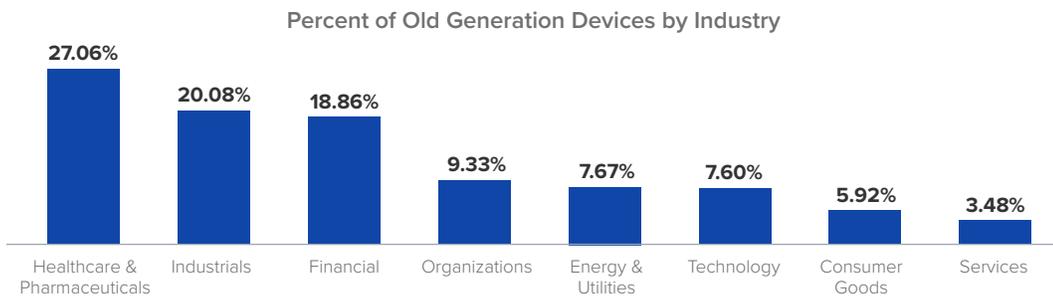
- **Device Score:** The ability of the employee to start and use Windows and the device without interruption (device reliability) and with good response times (device performance).
- **Business apps score:** The ability of the employee to start and use the business applications (other than the productivity applications) smoothly and with good response times.
- **Productivity applications score:** the ability of the employees to start and use productivity suite applications smoothly and with good response times.
- **Employee Satisfaction score:** it rates the feelings and perceptions of the employees when interacting with the IT environment (workplace, processes, people).

The Bottom Line

Imagine your IT team is set to replace 40,000 used laptops with one of the newest fleet of HP models. Let's take a conservative cost estimate of **\$2,000 per device** versus an upgrade cost of \$200. If you were to replace every device, it would cost your team \$80 million versus just \$8 million for an upgrade.

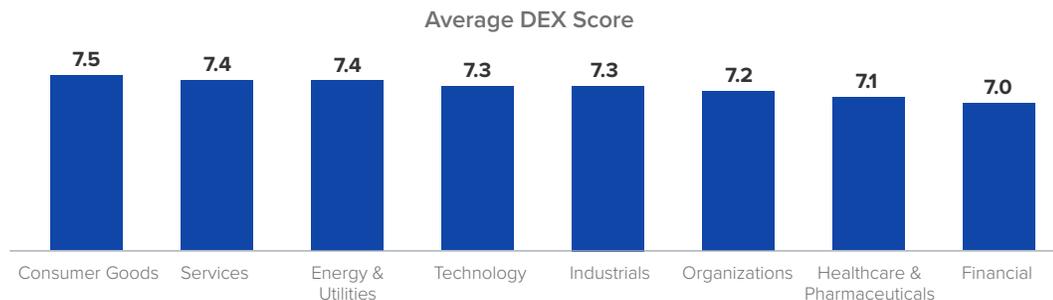
Our initial research gave us a good understanding about Corporate IT, but what about *specific work industries*? Could we identify which sectors had the biggest cost savings opportunities?

Looking across eight industries, we found that the Healthcare & Pharmaceuticals sector had the highest number of old generation devices (by volume) in use and the Services Industry had the least.



But we found the Consumer Goods Segment had the highest cost savings and salvage potential with over 28% of old devices posting a DEX Score >8, and only about 3% of devices recording a DEX Score <5.

Conversely, the Financial Industry recorded the least salvage potential with over 14% of devices posting a DEX Score <5 and only 14% of old devices having a DEX Score >8.



IT teams need to take a conscious decision to extend the shelf life of their employees' devices when appropriate. If not, they might be wasting millions on unnecessary upgrades, money that could be better spent on research and development or hiring new talent.

Next we'll show how machines that have high CPU usage, tend to consume more power and release more CO2 into the atmosphere. The key for IT is to find the right balance between high efficiency computing and low power consumption.

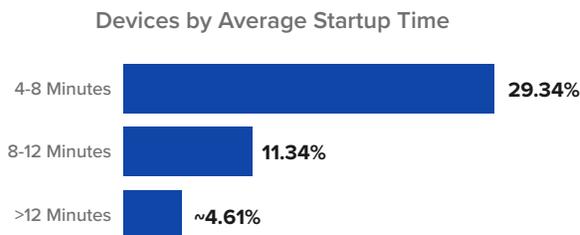
Device Startup Performance

What are the externality costs of a slow startup time?

A slow startup time can distract and disrupt even the most engaged worker. And if done enough times and at scale, this seemingly minor issue can seriously threaten an organization's productivity and negatively impact the environment.

In a previous [Nextthink Insights Report](#) we discovered that 43% of 3 million devices posted an alarmingly slow average of 9 minutes. This fact, identified by Nextthink during the initial deployment phase, meant that the unfortunate employee that worked on one of those laptops, was losing roughly one full workday (7.2 hours) each year!

But a slow startup time doesn't impact just productivity, it can also equate to hundreds of tons in avoidable CO2 emissions. In our new sample size of 3.5 million computers, about 34% clocked in above 5 minutes. For those devices, the average startup time was about 8.5 minutes—a wait time that equates to about 450 tons of CO2 emissions per year!



Knowing this, imagine for example an organization of 10k devices. About 34% of those devices (~3.4k) could take around 8.5 minutes on average per week to start up. This accounts for 481 hours of accumulated power wastage per week, or 21,193 hours of power wastage per year (considering let's say, 44 work weeks).

Going by the typical power consumption of a laptop computer which is 60 W/h, our fictional company would produce up to 1.3 tons of CO2 per year (using the U.S. average electricity source emissions of 1.011 Kg/kWh)³.



450 tons

The average startup time of 8.5 minutes equates to about 450 tons of CO2 emissions per year!

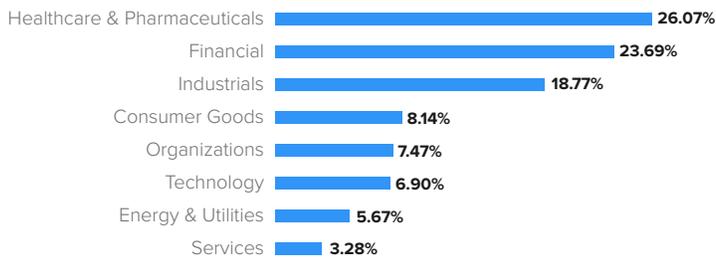
³ U.S Energy Information Administration. *How much carbon dioxide is produced per kilowatt hour of U.S. electricity generation?* <https://www.eia.gov/tools/faqs/faq.php?id=74&t=11>

Industry Type

We also were curious to understand device startup time and emissions by industry type.

We found that devices in the Healthcare & Financial sectors had the highest potential to cut down on CO2 emissions caused from a slow startup. We found that 50% of the devices that took longer than 5 minutes to fully load came from these two combined industries.

Percent of Devices and Startup Time by Industry



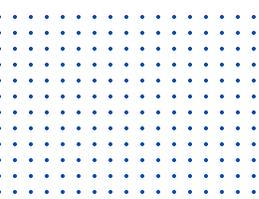
And conversely, the Services Sector was the least contributor of CO2e.

*As our team has proven before, a slow startup time often comes down to three simple fixes that IT can make:

1. Manage the number and type of applications installed.
2. Manage the number and type of applications in startup.
3. Upgrade old windows versions.

50% of devices that took longer than 5 minutes to fully load came from the Healthcare & Financial sectors.

*Source: [Nextthink Insights. Understanding Startup Time Across 3M Devices.](#)



Employee Computing Habits

How does software and internet consumption impact the environment?

The lines between work and personal life are more mixed today than in the past. Employees use dozens of applications, both standard and non-standard, but what they don't know is how their habits impact the environment. We set out to examine the environmental cost that comes from application usage to help IT teams educate their employees and drive awareness for more sustainable computing practices.

We discovered in our sample that collectively, gaming, personal communication, and media streaming apps generate about ~33 tons of CO2 emissions per year. To put that in perspective, it would take 300 trees an entire year to absorb those emissions from the atmosphere.

326Kgs
per week

Personal Communication Apps generate up to 326 Kgs of CO2 per week

350Kgs
per week

Media Streaming and Download Apps generate up to 350 Kgs of CO2 per week

17.5Kgs
per week

Gaming Apps generate up to 17.5 kgs of CO2 per week

Note: the above calculations were made based on the assumption that general internet usage produces about 28 g of CO2 per GB of traffic, and that these devices would be active for 44 work weeks.



33 tons

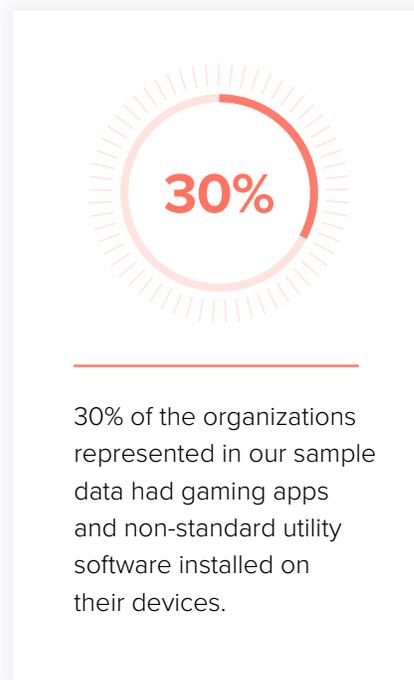
Collectively, gaming, personal communication, and media streaming apps generate about ~33 tons of CO2 emissions per year. It would take 300 trees an entire year to absorb those emissions from the atmosphere.

How did we arrive at 33 tons of CO2e per year?

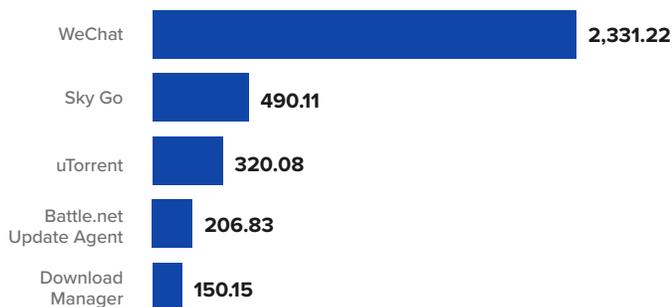
In order to make the connection between software/internet usage and CO2 emissions, we applied a conservative estimate made by researchers from a joint study at the Massachusetts Institute of Technology, Purdue University, and Yale University. In that study, researchers found internet use has a carbon footprint ranging from 28 to 63 g CO2 equivalent per gigabyte (GB)⁴. For our calculation then, we chose a standard level of 28g CO2 per 1 Gb of data⁵.

The Cost of Gaming Applications

We also discovered that roughly ~30% of the organizations represented in our sample data had gaming apps and non-standard utility software installed on their devices. And many of these computers consumed significant web traffic and contributed to a high CPU load. For instance, games like League of Legends, World of Warcraft, Battle.net and utility & media applications such as Download Manager, Sky Sports, and Screen Recorder contributed between 37% to 45% of High CPU load. Battle.net seems to be the most commonly used gaming application with a footprint in 15% of organizations and a web traffic consumption of over 200 GB per week!



Top 5 Web Traffic (GB) by Application



Top 5 High CPU Load by Application



⁴ ScienceDirect. *The overlooked environmental footprint of increasing Internet use.* <https://www.sciencedirect.com/science/article/abs/pii/S0921344920307072?dgcid=author#ecom0001>

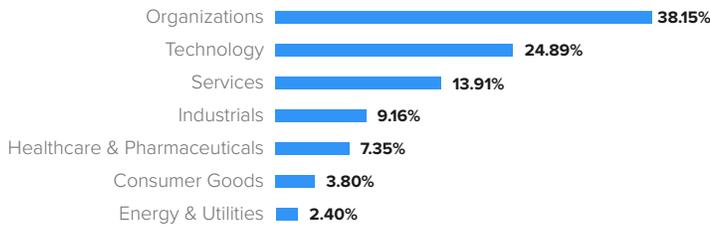
⁵ See 'About Data' section for more information.

And which job industries reported the worst internet usage and emissions?

Gaming Applications

Employees in the Organizations sector (NGOs & Non-profits) accounted for 38% of traffic generated by gaming applications, followed by the Technology sector.

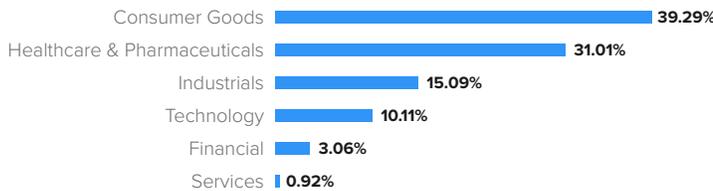
Percent of Device Traffic by Industry



Personal Communication Applications (like WeChat, WhatsApp, etc.)

Employees from the Consumer Goods industry accounted for 39% of the 326 Kgs of CO2 emissions per week in this category.

Percent of Device Traffic by Industry



WhatsApp was the most widely used application, installed in over 55% of organizations. And although WeChat was only found in 25% of organizations, the application contributed 13x higher web traffic consumption compared to WhatsApp!

Media Streaming and Download applications (like Sky Sports, Spotify, Amazon, etc.)

Once again, employees from the Technology sector reported the highest consumption of media streaming software, accounting for 29% of the 350 Kgs in CO2 emissions generated per week by this technology type. uTorrent was found in over 14% of organizations and registered over 130 GB of traffic consumed per week.

Spotify & Amazon Music topped the list as the most widely used software in over 33% of organizations.

Top Streaming Apps

- 1 Spotify
- 2 Sky Go
- 3 Amazon Music
- 4 Spotify Helper
- 5 Sky Sports

IT can help their organizations reduce a minimum of 695 Kgs of CO2 emissions per week simply by educating workers about smart computing habits and by eliminating applications that are heavy emitters. We recognize that some power-heavy business applications are simply too vital for the business to remove, but there's plenty of opportunities for IT to take more eco-friendly actions.

4 Tips for IT to Save Money and the Planet

To recap, we think there are 4 actions IT teams can make today that will save their companies serious money and reduce their carbon footprint.

We recommend you:

1. Identify and Organize Your Existing Hardware into 3 Buckets:

- Good & Ready
- Salvageable
- Expendable

Of the 1.38M old devices we analyzed, 20% were perfectly fine and required zero work. And of the underperforming devices, 98% were salvageable, only in need of a memory or windows upgrade.

2. Examine and Improve Your Computers' Startup Time by Taking the Following Steps:

- Manage the number and type of applications installed.
- Manage the number and type of applications in startup.
- Upgrade old Windows versions.

3. Identify and Remove Non-Corporate Software to Reduce Energy Emissions and Unnecessary Internet Consumption.

Many of the applications and plugins on the devices we analyzed were irrelevant for work and accounted for significant web traffic. The strain these applications cause on power consumption contributes to several tons of CO2 emissions each year.

4. Educate Employees on Green Computing Habits and Create Two-Way Communication Channels.

Employees and IT teams can help each other by sharing information on best practices and how their habits impact the environment. Many employees are likely unaware that their computing habits emits CO2 emissions. The responsibility rests with IT to educate employees and to provide tailored experiences that meet their needs.

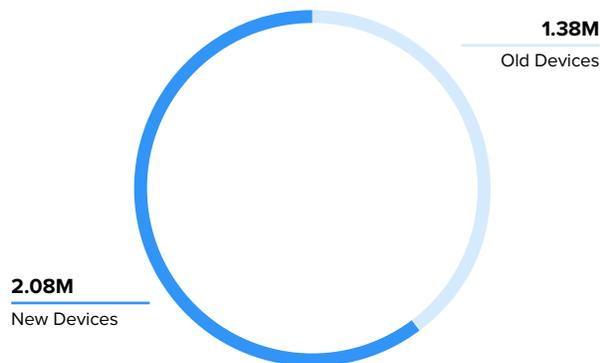
Explore [Nextthink's Green IT library pack](#) and learn how you can accomplish the objectives above.



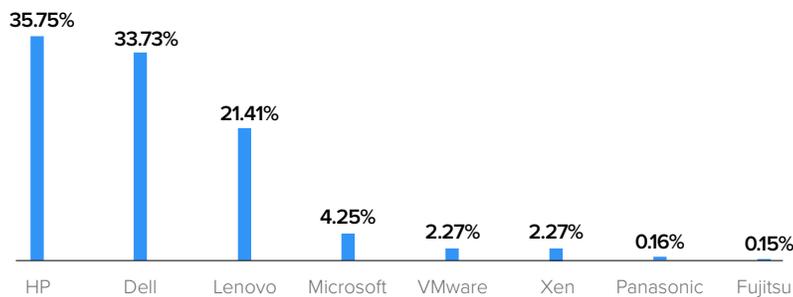
About the Data

Nexthink's customers are at the forefront of creating a more sustainable future and adopting a digital sobriety mindset. Because of this, they welcomed the opportunity to reduce CO2 emissions and waste across their organization, which Nexthink identified during the first few weeks of the partnership. This report focused on that data collected during the first weeks of Nexthink implementation from 3.5 million anonymized devices to study how IT leaders everywhere can reduce their organization's environmental footprint and costs while improving employee experience.

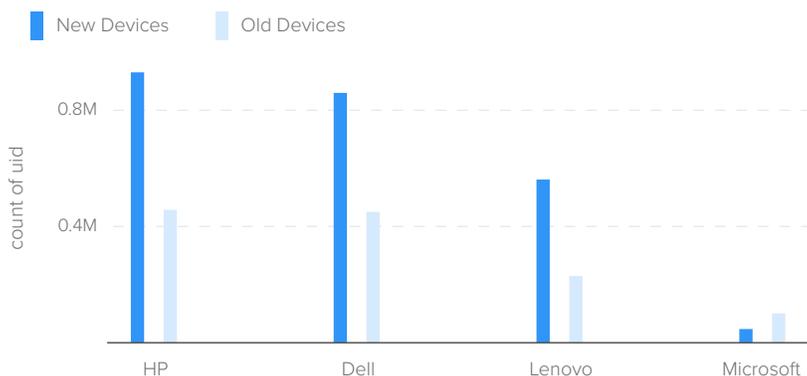
3.5M Anonymized Devices



Employee Hardware Usage



Ratio of Old vs. New Devices by Top Device Manufacturers



ABOUT NEXTHINK

Nexthink is the global leader in Digital Employee Experience management. The company's products allow enterprises to create highly productive digital workplaces for their employees by delivering optimal end-user experiences. Through a unique combination of real-time analytics, automation and employee feedback across all endpoints, Nexthink helps IT teams meet the needs of the modern digital workplace.

Have questions about the Nexthink platform?

[CONTACT US](#)

Computing Power & CO2 Emissions

The calculations made in this report reference the standardizations put forth by the [U.S. Energy Information Administration](#).

U.S. Electric utility and independent power electricity generation and resulting CO2 emissions by fuel in 2020

	Electricity Generation million kWh	CO ₂ Emissions million short tons	million short tons	pounds per kWh
Coal	757,763	767	845	2.23
Natural Gas	1,402,438	576	635	0.91
Petroleum	13,665	13	15	2.13

Based on the CO2 emissions per the above table the conversions for Start-up related emissions would be the following:

Total Devices	Avg Startup Time (mins)	Impacted Devices	Total Mins Lost/Week	Avg Power Usage (kWh/Hr)	Avg CO ₂ e/kWh (kg)	Total kWh/yr	Total CO ₂ E/ Yr (Tonnes)
10K	8.5	3.4K	28,900	0.06	1.011	1,272	1
1M	8.5	340K	2,890,000	0.06	1.011	127,160	129
4M	8.5	1.19M	10,115,000	0.06	1.011	445,060	450

Internet Usage & CO2 Emissions

Estimations based on internet usage and carbon emissions can differ widely based on the kind of internet usage one uses. However, we decided to apply our findings to the conservative estimates put forth by several American universities. In particular, one study calculates that internet use has a carbon footprint ranging from 28 to 63 g CO2 equivalent per gigabyte (GB)⁶. Taking this into consideration, we selected a standard level of 28 g of CO2 per 1 Gb of data to compare with our data set. From this starting point, you can quickly deduce that the software and internet consumption from the devices we analyzed would equate to ~687 Kgs in CO2 emissions per week, or 33 tons in CO2 emissions per year (assuming 44 work weeks).

Total Internet Usage in GB

Co2e/gb (gms)	Personal Communication Apps	Media Streaming	Gaming
28	11676	12517	625

Total CO2e in Kgs

Personal Communication Apps	Media Streaming	Gaming	Total Per Week
326	350.4	17.5	695

⁶ ScienceDirect. The overlooked environmental footprint of increasing Internet use. <https://www.sciencedirect.com/science/article/abs/pii/S0921344920307072?dgcid=author#ecom0001>