The Carbon Cost of Entertainment Industry

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Streaming movies, music, and online games often appears weightless and immaterial, yet every hour of digital entertainment consumes real energy. Data centers operate continuously to store and process media, networks transport massive volumes of data, and billions of user devices decode and display content. The entertainment sector significantly increases internet traffic, driving expansion of routers, switches, CDNs, and servers, thus increasing the embedded carbon footprint.

This project analyzes and quantifies the carbon footprint of digital entertainment, focusing on streaming video and music at different resolutions (HD, 4K, HiFi audio), multiscreen usage, and cloud-based gaming. It evaluates both operational energy use and lifecycle impacts, providing actionable recommendations for sustainable consumption.

1 Related Work

Prior research highlights the environmental footprint of digital media. *The Carbon Trust (2021)* estimates 55 g CO_2e per hour of video streaming in Europe, largely from user devices. Emissions can rise in regions with fossil-based grids (*Greenly, 2025*). *The Shift Project (2019)* warned that streaming contributed over 300 Mt CO_2e in 2018, nearly 1% of global emissions, with HD and mobile formats driving growth. *Herglotz et al. (2023)* show efficient codecs and reduced quality settings can cut device power use by over 50%. Most studies focus on single media types and ignore infrastructure or multi-device usage. This work expands the scope to include video, music, and gaming, linking operational energy to lifecycle impacts.

2 Proposed Approach / Methodology

The project integrates data collection, quantitative analysis, and lifecycle modeling:

- **Data Collection:** GB/hour statistics for Netflix, YouTube, Spotify; energy use of data centers and networks; server locations (EU, US, global); user behavior surveys (multiscreen, autoplay, binge-watching).
- **Carbon Footprint Estimation:** CO_2 emissions per hour of streaming or gaming, broken down by devices, networks, CDNs, and data centers; compare resolutions (HD vs 4K) and audio quality (compressed vs HiFi).
- **Infrastructure Impact Assessment:** Estimate energy and material costs of network upgrades and server expansion caused by higher demand.
- **Visualization:** Tables, graphs, and charts comparing platforms, resolutions, and behaviors.

3 Milestones

- 17.10.2025 – Project proposal submission
- 05.11.2025 – Literature review and methodology refinement
- 26.11.2025 – Data collection and preliminary carbon footprint calculations
- 07.01.2026 – Draft project report
- 12.01.2026 – Final project submission
- 16.01.2026 – Project presentations

4 Evaluation Plan

The project's success will be evaluated using quantitative and qualitative criteria.

Quantitative metrics:

- CO_2 emissions per hour of streaming or gaming by devices, network, CDNs, and data centers.
- Energy use comparison across resolutions and audio qualities.
- Impact of multiscreen use, autoplay, or binge-watching on carbon footprint.

Qualitative assessment:

- Clarity, originality, and feasibility of recommendations.
- Usefulness and interpretability of visualizations.

The evaluation also takes into account its alignment with the United Nations Sustainable Development Goals(SDGs), with particular emphasis on SDG 7 (Affordable and Clean Energy), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action).

5 Resources

Key resources include reports and datasets on streaming energy use and carbon emissions (Carbon Trust, The Shift Project, Greenly). Academic databases, such as Google Scholar, IEEE Xplore, ScienceDirect, and others, provide access to peer-reviewed studies on lifecycle assessment (LCA) of digital media, energy-efficient streaming, and data center sustainability. Software tools for data collection, analysis, and visualization include Python and Excel. The final report will be prepared using LaTeX, with support from the Faculty's digital library and computing resources.

References

[1] Carbon Trust (2021). *Carbon Impact of Video Streaming.* 55 g CO_2e per hour in Europe. `https://www.carbontrust.com/resources/carbon-impact-of-video-streaming`

[2] Greenly (2025). *How Much CO2 Does Streaming Emit?* `https://greenly.earth/en-us/blog/ecology-news/how-much-co2-does-streaming-emit`

[3] The Shift Project (2019). *Climate Crisis: The Unsustainable Use of Online Video.* `https://theshiftproject.org/en/article/unsustainable-use-online-video/`

[4] Herglotz, C., et al. (2023). *Energy-Efficient Streaming: Optimizing Device Power Consumption.* `https://doi.org/10.48550/arXiv.2305.15117`