GEM – Expert Events Season 2 – Summaries & Transcripts

Event Series: GEM Green Screen International Lecture

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GEM – Expert Events Season 2

Event Series: GEM Green Screen International lecture

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Introduction

Event series on Good Environmental Practices in Film Production

Within the framework of the GEM project, ten expert event series on the topic of sustainable media production are planned per season starting in autumn 2023 and ending in spring 2024.
The expert events want to create room for open live exchange between stakeholders from sciences and media students by concepting and implementing interdisciplinary panels. This will improve the openness to interdisciplinary discourse and help to develop students to take an external perspective on their profession.
With this event series GEM wants to empower students and teachers to make green changes in their institutions by providing knowledge resources and tools.
Furthermore, GEM wants to strengthen self-reflection about the sustainability of media professions by promoting dialogue and creative collaboration with science.

All online sessions are recorded in order to create sustainable teaching material for teachers and students of Green Education in Media.
For enhanced accessibility, subtitles are provided during the live session.

In the secund season (Winter 2023), curated by Prof. Dr. Björn Stockleben from Filmuniversität Babelsberg KONRAD WOLF, the focus is on good practices in film production.

Event 1 / Season 2

Environmental Impact of Digital Media Distribution

Date/ Time: 14.11.2023 | 15:30 – 17:00

This meeting marks the opening of a next season of events dedicated to Green Screen International lecture series. In the 2nd season (Winter 2023), curated by prof. dr Björn Stockleben from Filmuniversität Babelsberg KONRAD WOLF, the focus is on Good Environmental Practices in Film Productions.

The Erasmus+ project GEM will be introduced and an international overview of green production issues will be presented.

A German representative, Anette Wilson from RBB of green filming will share his insights and reports on green streaming.

Speakers:

- Impact of Media Distribution. Green screen lectures – Anette Wilson, RBB

Curator and Moderator:

- Prof. Dr. Björn Stockleben (Filmuniversity Babelsberg KONRAD WOLF, Germany

Summary of the 1st Event / Season 2

The webinar, part of a series on the environmental impact of film production, featured Marta Materska-Samek and Björn Stockleben discussing the GEM Green Education and Media Project. This initiative, supported by an Erasmus partnership with universities across Europe, focuses on integrating nature into education and reducing the environmental impact of media production. Björn Stockleben emphasized exploring

alternative media learning spaces, the environmental impacts of media design and production, stories of environmental impact and climate change, and developing nature-inclusive media studies curricula.

The session then shifted to streaming's environmental impact, with Anette Wilson from RBB (Rundfunk Berlin-Brandenburg) detailing the complexities of streaming infrastructure, including data centers and networks, and its significant electricity consumption. She highlighted studies on the CO2 emissions linked to streaming, underscoring the challenge of quantifying these impacts due to the absence of standardized methodologies. Wilson also discussed the industry's growing awareness and initiatives like the Greening of Streaming organization, aimed at reducing streaming's energy impact.

The German-funded Green Streaming project was introduced, aiming to develop a sustainable digital media value chain for streaming content. This project involves analyzing and optimizing every aspect of the streaming process, from video encoding to end-user device playback, using AI and machine learning for efficiency improvements.

Wilson's presentation included potential industry shifts towards sustainability, such as questioning the necessity of high-resolution content in all contexts and exploring the concept of "good enough" quality to reduce energy consumption. The webinar concluded with a discussion on the potential for returning to lower-tech solutions, such as broadcasting, to decrease the environmental footprint of media consumption, and the need for collaborative efforts across the industry to achieve meaningful reductions in CO2 emissions.

Transcript of the 1st Event / Season 2

00:03:03 Marta Materska - Samek
Welcome everyone at the second season of our impact on the environment of film production. I'm happy to welcome you in this new season and our main speaker will be Björn, the leader of our project and today meeting is dedicated to streaming.

00:03:31 Björn Stockleben
Welcome everybody. And so before we start with a topic and the guest of today, I will give a short introduction into what the GEM Green Education and Media Project is. Those who joined us last semester might already know about that, so I will try to keep it brief, but at least one time per series, so to say. I will give this short reminder what the frame of this presentation is, so I will share my screen for a quick introduction.
We actually started last year with the project with the Erasmus project, Erasmus Partnership, Green Education and Media, with a couple of universities, which are the Film University in Babelsberg, the Jagiellonian University in Krakow in Poland and the Łódź Film School in Poland. In Tampere we have the Tampere University and the Tampere University of Applied Sciences. Then we have the University of Zagreb, Malta University, University of Athens as partners and the Institute for Art and Innovation.
Did I forget anyone, just to be sure? OK, Sophie says I didn't.
So it's quite a large Erasmus partnership and what unites us is the search of how can we get the environment, nature and the nature back into the classroom? Because we're keeping dwelling in those digital worlds and creating or creating those digital platforms

and services to create fictional worlds and TV series and so on. And we ask ourselves, why do we keep envisioning, well, something like this, if we'd rather live in a future that is more sustainable, embraces nature instead of replaces it. And one answer might be because we teach like this in concrete buildings from the well actually from the year 2000. I wanted to say like the 60s, but this is actually a rather new building which still is like concrete and only because we work with computers. Why can't we learn like this? We actually did learn like this last summer we had a one week workshop with partners from all over Europe, from all those mentioned universities where we had a workshop on green storytelling, storytelling for sustainability right in the middle of nowhere in Brandenburg and it was really nice. Still there was a little bit more technology than just like that. But the mood, I think the mood is like it was there. So that is what drives us. So why are we so, so far from nature? Just because we do these digital things and how we can we reconcile it again? Well, actually what I've just said is here elaborated not in a nutshell but rather worth the worthy what's rather verbose. So I skipped that slide for the sake of saving time and I give a short overview in the particular topics that we have. So we are looking into alternative media learning spaces. So that's what I just showed. So is it possible to teach technology, subject media technology and film production, interactive media in nature, in natural settings and in other settings than just concrete buildings? Then we have the topic of environmental impact of media design and production. That's where we are right now. We're asking the question, our craft of media and film production, how does our production process and our craft and domain as such contribute to climate change and pollution and CO2? And how can we contribute to be more produce, more sustainable and more responsible? And then we have the topic in the work package, four stories of environmental impact and climate change. That is the question where we look outside into other domains and sectors and see how what can we as storytellers contribute with our craft to basically make a better planet. Make the world we live in better. And in the last work package, the sentence hasn't even been finished, which is a running gag for a year now, but I think I'll never finish it. It's or we finish it at the end. The question: How can we put all this together to make a better, to make better and more nature, near nature, a theme curricula in our media studies and break the concrete wall towards the outside, the nature that is there, we just have to go there and find ways to embrace it. Going back to as I said environmentally or well, just some short examples. One thing we did a lot is theme nature works where we went outside and had discussions and inspirational sessions not around the table but in the open while walking while getting inspiration from nature. We tried different tools also where we could digitally collect artifacts from nature to put it into the digital space. And we are also looking for ways to kind of get back from the digital space into the analogue space. And another example was a world building workshop with Juan Diaz and Alex McDowell back in last December. Where Which is world building is a storytelling technique which also helps to envision more coherent, more sustainable ecosystems. Well, these are the participating universities again and this is the last slide which tells us this has been generously and is still generously funded by the European Union in the Erasmus+ Program. As I said, we're now in the theme of the part of the project with deals with a well impact on sustainability with the carbon imprint and the general sustainability of media production. And I myself, I also have a background, so now I'm professor of media production but film and media production, but I have a background in media technology and have been dealing also a lot with the distribution side. And actually after we finish producing our content, there's a lot of happening. We, we are putting in place a large distribution machine, a huge machinery, a huge system which has a lot of which well creates a lot of CO2, has a large carbon footprint. And on the other hand we haven't even really started looking into where exactly

there's potential for more sustainable solution. Where can we can save CO2 what really is the impact at which part of this chain.
And this is why I invited today's guest Annette Wilson from RBB, the Rundfung Berlin - Brandenburg, the public broadcaster of the German region of Berlin and Brandenburg, part of the ARD network. And she was to be joined by a researcher by Ahmed from Fraunhofer Focus, who is responsible for the technical part of the project that she will be introducing. He unfortunately cannot be here today because of a mental of a health condition as he just had to notify us and so we have to excuse him and if you have very deep technical questions, just you can ask them and we can tell you later. So unfortunately he cannot be here today. But Annette is here and I'm very happy because I've been working with Annette for quite a while, for a long time when I was still at RBB in research you European Union funded research projects. And it's very interesting and exciting to see that a broadcaster sees this responsibility also for not only the content that is created but also how the content is created and what impact all this has. So Annette, welcome. You're head of the RBB Innovation Projects Group, if that is still the correct term?

00:13:19 Anette Wilson
Yeah, it's still more or less correct. Thank you for inviting me.

00:13:24 Björn Stockleben
So if you like, you could simply start and then after your presentation we'll get into a conversation. I will ask some polar question 1st and then you can come in with the more direct straightforward questions that you always wanted to ask to somebody from RBB. If you ever wanted that. Today, you should want.

00:13:47 Anette Wilson
I'll just show my screen Björn if that's OK. So you can hear me and you can see my screen? Well, thank you for the opportunity to talk about the impact of media distribution. Today in particular we're going to look at streaming, which I must admit is something I didn't realise that had such an environmental impact until last year when we start looking at some figures and it's quite shocking actually.
So first of all, what is stream? What are we talking about when we're talking about streaming? We're talking about the transmission of audio and video data via the public Internet is the transmission of OTT, so over the top content from and through multiple IT infrastructures, data centres and wide area and telecommunication networks. So you can from that bullet point you begin to get a feeling of how complex the whole streaming issue is. Streaming also covers video processing and encoding of the videos, for example real time coding for live streams and it also covers then finding the display of the media content on the end devices used. So streaming covers quite a lot. It's if you think about it first, you think possibly you just have a file that goes from HD, but there's from getting that file to HB. There's there are a lot of complex technical steps involved, as I said, unfortunately, as you said, unfortunately Ahmed isn't here, so he could have told you more about those complex technical steps.
I'll just kind of breeze over them. So how does streaming affect CO2 emissions? Well, all these components we've been talking about involved in the production, the technical distribution and displaying the content that on the end devices, they all consume electricity, quite a lot of electricity. At the same time, there's a growing use of streaming services and Netflix, Disney Plus for example, especially during lockdown during the pandemic, I'm sure you're aware there was a big shift towards streaming. There was a

large rise in the amount of content being streamed, and there have been various studies done on the impact of modern meetings on the global climate. Trying to find equivalency or two emissions related to one hour of streaming. And it's not too easy.
So here I'll just go through some general figures. So in 2019 75% of all Internet traffic was video streaming. And if you look on the right, so you see Netflix is responsible for 15% that was in 2022 of global Internet traffic, followed closely by YouTube with nearly 12%. You can also see they're on bottom Disney, TikTok, Facebook and Prime.
So that's a huge amount of Internet traffic is just about streaming. The prediction for 2022 that mobile traffic 79% would be video, video streaming. What we're also observing, especially in Germany, is the growth of so-called OTT only households. It's households that don't use broadcast, so where when these households consume video content or audio, it's all streamed. The energy consumption for one hour video streaming is approximately 0.3 kWh. That's one of the figures that gets thrown around. And another study came up with the figure that one hour of Netflix streaming is equivalent to driving 400 metres. So just from the last figures I've mentioned, you could probably guess there's been various studies done and the results vary greatly. If you look at the table on the right hand side, this is one that RTL Plus released, they did a, they conducted a study on the effects of streaming and the values there range from 32 to over 3000. So it's just there to give you an idea of the of the range of figures that you come up with. And it all very much depends on the approach and the methodology used and this varies greatly.
One of the problems is there's no standardised definition of the entire streaming value chain. And it's quite difficult then to measure the system, the energy used by the all the individual system components and the networks. So the common approaches used are approximating the proportionate power consumption of the network used with the help of average values per data volume or the power per user model which allocates the basic power of the systems to a user based on the volume of data used by that particular user.

So various approaches, none of them standardized, we're still kind of in the dark of it.
So what's the industry doing? Well, there's been with the increased amount of streaming going on, there's definitely a growing awareness. We've been able to observe this over the last few years. Various initiatives have started, but one to definitely keep an eye on is screening of streaming. If you don't know agreement, streaming is an organization created to address the growing concerns about energy impact of the streaming sector. So really looking, try also trying to look at the whole big picture, lots of industry involved. So Fraunhofer Focus who are the coordinator of the green streaming project that I'll come to in a minute have also joined the greening of streaming initiative. The EBU, the European Broadcasting Union is a member and various large concerns and one of the approaches they looking at in greeting streaming is what they call good enough. So what's good enough? Does it always have to be the highest resolution video that you watch on your end devices, for example, if you're talking about, I don't know, a television that's in your kitchen, in the corner of your kitchen, and it's just basically on as more or less as background noise, you really need to have like high definition video playing on this type of television. Because one of the main culprits when it comes to using large amounts of electricity are the are the end devices, especially the televisions.
OK, so against this background we were lucky enough to submit an idea for a German research project last year and get funding. So the project is called Green Streaming and it started in May this year and will run until April 2026. And that's been funded by the German Federal Ministry for Economic Affairs and Climate Action. I think the funding altogether is just around four and a half million mark and we've got six partners in

project. So what's the objective of the project? So the objective is the development, testing and application of measurable and accessible sustainable digital media value chain that enables the seamless, holistic and demonstrably green provision of streaming content. So if you look at the graphic here, you'll say there's lots of along the whole streaming chain. There are lots of challenges and but opportunities. So when it comes to video and coding, when it comes to the transmission and when it comes to the playback and these can all, if we tweak all of these, we can help produce the overall energy consumption. That at least is the thesis we're working on. So the challenge I suppose, of the problem is the total energy consumption is mainly influenced by distribution, storage and use on end devices. And the technical complexity of a video of video content depends on the type of content. So if you have for example an action movie, the actual content is more complex than say if you have maybe an animation or you had a simple news program where you just have a talking head that's not that. That content isn't as complex as of the content, and this is where encoding comes in. So fortunate that Ahmed isn't here, because he would have been able to tell us more about the types of encoding that are possible. You also have to consider the quality of service, but also the subjective perception of the contents of the quality of experience and energy efficiency. So you're trying to bring these three aspects together, which isn't, which isn't too easy. And we're also looking at the establishment of suitable measurement methods and recognized approaches to impact the chain analysis. And finally, the amount of data used correlates only slightly with the energy consumption of the system components of the transmitting infrastructure, because if you've got a server, even if you're not transmitting, the server still on the server room still running. So it's not always 1 to 1 correlation of how much data is being used and the energy consumption. So the approach we're following in the green streaming project is we're starting off by want to analyse all the components along the streaming value chain in terms of energy efficiency. So we're looking at the audio video encoders, we're looking at packaging, we're looking at the content delivery networks and we're looking at the players and end devices. So that's what we're doing at the moment. In fact RBB we're in the work package that we're leading and it's quite a challenge. It's actually more of a challenge than I would have thought just due to the complexity of the issue, but we're nearly there which is good. And once we have this, once we've basically described as we call the streaming chain and we have all, we've identified all the components. Then the next step is to go on to measurement. So identifying the points where you can measure where can you physically measure the use of the consumption of electricity, definition of the variables, collection of component specific measurement data and use this for the optimization of the chain with the aid of real time data from processing and playback processing. To help us with all this, we're using machine learning and AI models and one of the results of the projects will be green digital, twin of the streaming supply chain that would help us with future and future decision making. And we hope that the result of the project will be a measurable, accessible streaming value chain that enables substate, sustainable operation and sustainable use of streaming content.

So the expected project results are we hope to have a CO2 balancing for streaming, we hope to have analysis and measurement tools. So really by, as I said by looking at all the components for each component, trying to figure out which is the best way to analyse it and measure it. We are looking at AI media workflows for hybrid production and stream analytics. So when I say production, we're talking about production of the signal not green production, which is a different thing altogether. We're looking at AI supported contextualized video encoding. So this is what Fraunhofer Focus are doing. So really

looking at how you can depending on the type of content and the type of video, how you can really encode it best and how AI can support that process. We will hope to have the green digital twin of the streaming supply chain. So this is something that we'll be able to use to help us in decision making to help simulate. So if you know, if we change one thing here, what will happen further down the stream. What we're also going to do is we want to test a green streaming mode for consumer devices. So we'll test that in terms of acceptance, in terms of usability. The idea would be on, for example on HDTV that consumers can actually actively say I want to watch the green stream. So that might be it might be that the quality or the it's not high definition, the quality is different. It might be that it somehow reduces the brightness of the of the screen being used. We still have to we're only starting to talk about the possibilities here, but the idea is to empower viewers to make a choice. So further result will be the criteria for sustainability assessment. And at the end of the project, we also hope to have a CO2 calculator for video streaming. So unfortunately I only had this diagram in German, but I'll talk you through it. So it's the green streaming of the project architecture. So if you look at the left hand side, we've got the production because it shows the I suppose the architecture but also the role the partners involved play. So we're looking at production, we're looking at hybrid production cloud versus on premises solutions. So when it comes to signaling then we'll be going on to look at encoding and packaging. This is where Fraunhofer come in with content aware encoding using the AI models developed by the company DPA. Then we look at distribution, so how the different distribution networks and then the computing power needed for these and the general the to save the data. So this is really good that we have telecom as a partner in the project. So because these are measurements that RBB for example could never make because we work with service providers such as such as telecom and then when it comes to on the right hand side we have then the end the end users or the viewer. So looking at playback and usage. So we'll be using stream analytics from Fraunhofer and we'll also be looking at developing as I said to the green, the green streaming player together with Telecom and Fraunhofer. And at the end we hope that at the top we're saying we want to have this green digital twin of the whole value chain and we'd also want to have it as CO2 calculator. This is where KlimActiv this is an agency that works on climate issues as will be helping us. And a further issue we're looking at is if we can come up with a certified green streaming label, not sure if we manage it but we'll try our best. And then on the right hand side you see we've also got a few association partners RTL so two are to bit moving. So we're quite as a consortium, we're quite open and the interest of these other partners reflects as I said there's a there is a lot of awareness in the industry about the about the issue and I know over to coordinates the project said he was at the IBC and reckons to become known as Oh yeah, you're the German green streaming project.

So I think there's a lot going on at the moment and I hope we can we can contribute to the whole issue with some really helpful results.

So that's kind of going from the global view to what we're doing in the projects. But you could ask why is screen streaming important for RBB as Björn described RBB with the regional broadcaster for Berlin and Brandenburg. In fact, when I'm in the office I'm just around the corner from Björn and the Film University. We're on the same street and we're I suppose a small broadcaster, but we're also part of the ARD. So if you look on the right hand side you've got the map of Germany. The ARD is the network of all the public service broadcasters in Germany. So I looked at some streaming TV viewing and streaming figures for 2022 and for television overall in Germany, 251.8 million hours of TV content is viewed daily and that includes 6.8 million hours of streaming daily. If you

then just go to the so that's all TV content in Germany if you look at the ARD channel. So total daily consumption is 80 million hours, which includes 2.9 million hours of streaming. So that's kind of mind boggling amount of time, hours of streaming when you think about it. So we decided that RBB would be we want to become more sustainable. We're doing it in, we do green production. We're now trying, we're now looking at green streaming and see how this can all be used to reducing our CO2 emissions. So we intend to use the project results and findings to make program distribution strategies and processes more sustainable. But I mentioned the ARD before and that's important because we don't operate in a vacuum. So the RBB wants to establish new technologies within the ARD because we're all the time we're moving towards shared infrastructures and we're involved in all the important working groups there where there's also a lot of interest in the topic. We'll describe the streaming value chain in detail, analyse its individual components and processes and basically based on this developer best practice workflow for sustainable media distribution. And as I mentioned, we want to implement the green streaming mode as a prototype type in our HbbTV and web-based video players, which we will then test for usability and acceptance. And what we'd also like to do is analyse and compare the CO2 footprint of the different distribution channels, because as you know, there's not just streaming, we still also have for example broadcast. So looking and seeing if there is any comparison and if that maybe is interesting for future programming distribution. So that was it.

00:35:35 Björn Stockleben
Thank you very much, Annette. And I wanted to give you a hand. And what I find remarkable here is that I see a reoccurring pattern. So in the early days of streaming, so there was also a lot of talking about adaptive encoding and making actually with the aim of being able to transmit a stream at all. So that we have a very small capacity in early smartphone networks and we try to bring across to transmit at least a bearable stream. Now we're way beyond that. We have we have glass fiber networks, people have 50 megabit connections at home and so on. And what we're doing is we're not trying to see, OK, this is not what we need and we don't take more but we take all we can get. So we stream like 4K videos to HDTVs and just having data, transmitting data that we actually don't use, we don't see the advantage and it's like by the I asked myself, so now what is the first, what is there anything we can do right now as consumers and would there be anything right now where you say, well you can do this even without developing all this and we will help to increase the carbon footprint of your media consumption apart from not watching TV but.

00:37:12 Anette Wilson
Decrease, turn down the brightness of your television.

00:37:19 Björn Stockleben
That's a very practical tip.

00:37:21 Anette Wilson
That's it was interesting because it was one of the discussions we had when we were talking about the project. Because we're saying it's actually, it's quite political because for years we've been saying bigger, better, brighter, some more high definition. And actually what you need to be saying now is the good enough approach. So you actually don't need your television. You don't need such a big television. You don't need it so bright and you

definitely don't need it in such high resolution all the time, depending on maybe on the content, on the usage situation. So you know, try and be a bit more smart about how you watch it and maybe sometimes broadcast is the solution.

00:38:05 Björn Stockleben
With brightness, the interesting thing is that actually you perceive it in contrast. So it's like using less salt you initially you might tell it but if you get used to it soon you will notice a barely a difference, at least that's my experience. I think also in in already there are clients streaming clients where you can choose whether you want a high quality or a lower quality stream. Although I really like the approach of the green streaming option because it's another choice you take. If you choose to be more responsible and sustainable, you're probably more likely to take that choice than to take to the choice of a lower quality. So if you ask the question do I want a lower quality or a higher quality, you say, well I want the higher quality, but if you ask the question do we want a high or low impact on the environment, you might opt for low so. So how will you implement that by the way? Maybe how will that? What does it look like for the user?

00:39:18 Anette Wilson
We don't know yet. We because we haven't started. So I think, I'm not sure where we'll do it. Do you do it in the settings or do you do it as a, you know, kind of underneath when you open the media takes or your video library do you say, you know, like you choose maybe subtitles. Do you have a button that says give me this in green? I want the green version of the stream possibly.

00:39:43 Björn Stockleben
There might be also the question whether you actually find it if you go to settings and then the subpoint stream and then sub item stream and then you have a sub item and so on. So or maybe it could also be ideally it would be mandatory so that if you turn it on for the first time, so do you want do you want the sustainable stream? Yes or not. As I said, I really like because it takes an option that is actually all there, already there in a way, because you can choose lower quality into a more positive question which turns around the obvious answer. Yes, I want high. No, I want low impact.

00:40:27 Anette Wilson
And it probably makes more sense not to have it in the settings now that we're talking about it. Because as you said, it will be hidden somewhere within in a sub menu. In a sub menu where if you actually have kind of a big green button under each video, you can feel good every time you press it.

00:40:46 Björn Stockleben
Well, once more about this, we wanting more if there's the room for more, I think this also translates well into the world of production and post production. So often if you render pictures if we use cloud editing or so in the former days there had been the option as it were, well we still do offline editing but in the 90s it was what you did. But if you wanted to edit a video on the computer you would have a very low quality offline edit and then it would take a long time to render the online edit with the full resolution. But in in many cases you can do the edit a 4K video with a HD or even SD stream to do the rough cut you could do that but just because it's possible and it feels like a bit more comfortable, we go for the option maximum quality. Unless your network says well I can't handle that

only then we would turned down as well with for example rendering capacity. By the way if anybody has a question please put it in the chat. Maybe what could be interesting if I quickly, I don't know whether everybody's familiar with actually the well how streaming distribution works. So maybe in a nutshell, because you mentioned the Content Delivery Networks, the CDN. So actually it's not like one point, there's not a server at Retesting's home which handles all streams that go out to all Netflix users worldwide. But there's a wide, wide network, Content Delivery Network which consists of hundreds and maybe thousands of intermediate nodes which distribute streams.
So it's like a tree structure. So you start, you have one stream feed to maybe the broadcaster, so from RBB to Telecom and they then distribute they recode the stream and send it to all their delivery notes so that the and from these delivery notes it comes to your home basically. So it's really like a multiplying structure in it. It multiplies an effort. So anything you save for example in the encoding of a stream will also have a multiplying in Well, a in how it's how you call it potent factor, well it will mount the effect will also multiply.

00:43:41 Anette Wilson
Exactly and that's why I said it is for us it's really good that we have telecom in the in the project because obviously we don't, we're not, we're not a content distribution network provider. So we'd typically use somebody that provides this, the big players or Amazon Web Services or Akamai and we've got telecom in the project. So we can actually gain a lot more insights into the whole that whole kind of CDN power consumption.

00:44:12 Björn Stockleben
We have a question by Wojtek, please.

00:44:16 Wojciech Olchowski
Yes, thank you for great presentation. I would like to add something. It was amazing presentation Anett and it's really like enlightening and great to see this from broadcaster point of view. And I remember that we talk a lot about this during Berlinale Talents Workshops 2 years ago during online Berlinale edition. But after a long consideration one of recommendations of kind of young film makers community they were actually to like we should we should try to come back to shooting in 2K which was very brave and most people were like it was huge decision for them to not go for 4K shooting. But about the distribution, we thought that it could be very interesting to maybe try to advocate for the European Union regulations for especially TV screens or TV sets producers to much more develop upscaling on the end of TV's set. But actually this what we are screening should be the lowest went wide maybe hypothetically could be HD but if you have four KTV your TV should upscale this to 4K if you really want to have it like this. So it was how I remember it was 2 main propositions from community that we as a team makers should consider shooting again in just 2K but from the end to making post production in 2K. But the presentation for viewers should be more on the hardware level of the TV screen and all AI and all development of technology should be forced on the producers of TV screens. It was general to propositions I think. I still think they make sense but they open we stop it after the Berlinale talents it opened question what actually viewer will see in documentary film if TV screen will upscale this to 4K because it will not be visible like faces in the far background of the crowd. When you have for example shootings which you also face have sometimes mobile phone shootings in documentary film and you upscale this for your film but still it's not reality. It's something which algorithms are

creating like faces of the people in the crowd. And if you put low quality or low resolution documentary film in the even now existing modern TV set and you will choose upscaling to 4K, it will give you these faces. But this is AI approximation of faces, it's not really documentary. So it was many interesting subjects during this Berlinale.

00:48:13 Björn Stockleben
There are two interesting aspects in it. But first, maybe Annette, if you have an immediate answer to this.

00:48:20 Alette Wilson
I think it sounds very interesting. As I said, I think, I think the TV manufacturers obviously wanted to show, you know, bigger, better shinier TV's and that possibly needs to be questioned. I think what would be really interesting is maybe to look at that approach and compare it to the encoding because at the same time we still want to enjoy content. So you know it's just kind of I think you know let's not kind of put everything back to 2K but maybe there are situations and try and work out the scenarios when that makes sense and how you can use the technology like the encoding to really then reduce bandwidth so that you have you know, so you're only using what you need to use.

00:49:12 Björn Stockleben
One interesting aspect of this is also the question where do you put the processing power. And this is also one reason why it's so important to find out where actually the energy is consumed, for example of course if you do video encoding you can do this. They are symmetric encoding algorithms which mean the encoding is as fast as this what is as complex as the decoding. Or you can have algorithms where the encoding is quite complex, takes a long time and the decoding is very simple and fast. And this is mostly the approach. So if you have for example use Adobe Premiere, Final Cut or Avid or so and you press the encode button then you see that it can take a long time if you do an high quality encode. Still it decodes in real time on the smallest device, but for example for provider like for telecom service. Of course they could say well if you put more load on the end user devices and have less complex encoding, maybe we can save some energy in our in our data centre. So while there would be more energy consumed by the end user devices. So I don't know whether how this balance would be so, but this has really to be found out because here we would have a decision, a trade off the company. For the company it's cheaper to have the end user devices do all the work and for the end users for the environment it would be maybe more efficient if the data centres do more work, but as said this is not decided. As for the upscaling that we come into the artificial intelligence debate I would say which is a bit too far for today's session or too far off from today's session. But I can say that to my experience, TV manufacturers tended to use the lowest quality processor that we still does the job, the weakest processor that still does the job for the TV. So if you want to have an AI enabled processor in your TV then the TV would also get a lot of more expensive and the TV market is highly competitive so that might be well an issue. So usually they build on very low key hardware unless you buy something very fancy. So like ATV that Apple would build but they don't build TV's but just the streaming box. Well which would maybe be able but still in the Apple TV box you have a comparatively weak processor. But this just as a side topic.

00:52:11 Anette Wilson

But you mentioned something important Björn and that's what I think we're trying to address is this if the Telecom says OK well we do less you know we do the kind of the decoding happens in the TV and then we as a Telecom company we look like we've got a lower carbon footprint and that's why we're trying to look at the whole stream and have this. My hopes anyway for this digital twin is that we can then. You can do that type of kind of maths if you like that you do the modelling and say OK so if we did less here and more here you know where do you end up at the end of the day I mean is it really more efficient.

00:52:58 Björn Stockleben
It's probably very important that it's not a game where there's where everybody is separately wants to optimize their CO2 footprint, but where you have to look at the whole thing which is really the most, the best approach to it, talking about the best approach. So traditionally you still have a lot of broadcast viewer. I was actually a bit even amazed about how high the ratio of broadcast to stream consumption still is. So it's a lot of stream streaming use for the ARD users or viewers, but it's still a vast amount of hours that is watched via broadcast TV and actually broadcast well in a way it's pretty efficient. It's one signal for all, which is very powerful, but it's just this one, it's a couple of broadcast antennas, but still, did you do you by chance have any comparison how this compares the traditional broadcast to streaming?

00:54:06 Anette Wilson
No, but it's something we do want to look into. So then you're looking at user figures and we have so one company that we're doing broadcast analysis as far as we're able to tell us based on HbbTV viewers. So they could, they knew what type of screen that they were looking at. So it was it was broadcast TV but because you've got the, you know you've got the start bar on HbbTV. So they had an idea of the of the screens that that were being used. So they could do, I mean it's still only modelling that we were doing, but they could do slightly more realistic modelling. But that's the next step. I think it would be quite, quite interesting to look into.

00:54:55 Björn Stockleben
And probably it's all interesting. Also interesting how many users so there. There's probably a threshold of minimum users for the broadcast to be efficient, which might also be a huge topic. But well, it also made myself consider why should I again this notion of, well, it's available, you can watch it anytime. So I take the stream. So and it's just for comfort but I could also make it a habit t o watch certain shows again when they are broadcast so and could dig out my old DVBT receiver again so but I admit I it's right now stored away and I have I haven't used it for quite a while but maybe I'll take it out again maybe. Not sure yet.

00:55:51 Anette Wilson
Well, for live events, say for we had a conversation with my kids yesterday about football because they were saying that, you know, they'd had some debate in school whether you should stop the European Championships because of the environmental impact. And saying what about the streaming impact of football? And wouldn't be better if you use more broadcast than streaming. So maybe we need to go back to everybody sitting around on the sofa watching the one TV screen.

00:56:22 Björn Stockleben
Yeah, yeah, sharing screen is probably watching more together. The well in the 60s when you were meeting at public places to watch TV actually and you were watching the SD television, which was far away. But well, so back from the 60s to the present - Tuomo, who has a question.

00:56:48 Tuomo Jaronen
I kind of have two questions because I mean streaming has replaced or what it basically has replaced is this DVD distribution. So I mean is there any kind of idea like how does it compare to this DVD distribution? I mean, it's long gone now, but in some sense I feel like I would really be happy to know like how much people would be driving somewhere to get to loan the DVD take it home, watch it right back there returning it and then sort of when I was thinking about these old technologies that have died out. So I kind of went all the way maybe 50 years back to the time when in Finland we only had black and white TV and I don't know, maybe that could be a thing to what's everything in black and white. And I think based on how the encoding is done, I think black and white would actually be probably way less data being transferred if it would be black and white. And I don't know maybe it could be a thing for hipsters. I'm being very sustainable here. I'm only watching my TV on black and white. That's just kind of a weird idea. But whatever it takes maybe and I mean black and white, I mean, it's cool, maybe that could be even one option going.

00:58:42 Anette Wilson
Black and white in silent.

00:58:45 Tuomo Jaronen
Yeah, with only text, but some of these, the thing that streaming replaced was DVD distribution. Is there any like because I think it probably was kind of energy heavy thing as well. So, I mean, naturally there is the need to take down the energy consumption no matter what. But it would be also fun to know if the thing it did replace was even more high in energy consumption.

00:59:23 Anette Wilson
I don't know of any studies, but it's an interesting one.

00:59:28 Björn Stockleben
Yeah, maybe what can say to if you compare the analogue TV, so which you are also referring to, if you're talking about black and white themes and the digital TV, then I would say the energy consumption was lowered by a factor of about 4 to 8 because what was one TV channel became one transponder for which could hold 4 to 8 digital programs. But well, yeah, the question of what, how digital TV fair broadcast fairs against streaming that. So I don't have any numbers. And you also already said, Annette, that you're not aware of a real comparison.

01:00:18 Anette Wilson
I haven't got any. I'm not saying there wasn't any, but I haven't got any.

01:00:21 Björn Stockleben
Wojtek?

01:00:26 Wojciech Olchowski
Yeah I would like to make it as a question but I am almost sure of it it's that field because even I it's one more thing which I remember from this two years ago Berlinale Talents which also was time when I had so many doubts about my field of creation which is 360 video and not VR which is interactive and in your the hardware but actual streaming of 360-3D video. And comparing to problems with green production and green streaming which we consider this two years ago where people were open for example shooting again in 2K or some regulations or limitations of streaming. I said yes, but what we are really waiting what we really need for streaming immersive 360 video is something around 8K, which is like killing all green propositions. And it was actually one of the reasons why I switch my mind for VR, which is kind of more green because it's the one file to upload, maybe 2 GB, but this is just one file and you can start this on your on your computer or maybe sometimes on your VR headset. But putting this high, there are even 12K files and 8K is definitely on YouTube and streaming this to just check how beautiful is jungle or desert. It's so not green that it's it broke. Any other options which 360 video supposed to give like making lower carbon footprint because you are not travelling to jungle but millions of people will watch 8K streaming on YouTube of 360 8K video of this jungle. So in general it was some kind of decision for me that no I don't want to be part of this run for higher and higher resolutions which unfortunately in my medium in 360 video it only makes sense like something which is even 4K streaming in 3D. It's so low resolution for viewer in VR headsets that people not enjoy it at all. So maybe I will finish with just a question.
Do you still any way are considering or interested in producing or streaming 360 contents in high resolution, obviously as a RBB?

01:03:30 Anette Wilson
That's an interesting question. We haven't done anything in 360 for a long time because it's just it's very difficult, it's very expensive to produce and then you need the players to do it and it's still kind of niche for us at least. So no, I think we're just kind of having budgets cut and struggling just to do flat videos.

01:04:03 Björn Stockleben
Yeah. Thanks a lot. Are there any more questions we can call it a day or Annette, if you want to add anything from your side. I will also have some few words for the closing.

01:04:26 Anette Wilson
No thanks for letting me present the project and if you've any questions don't hesitate to get in contact.

01:04:33 Björn Stockleben
Thanks a lot for your presentation and I thought it was really a good insight into a part of well the media production chain or the media value chain that we often overlook at as content producers. And you also showed that even as a as an end user, we have a certain responsibility both as a producer and as an end user to minimize the carbon footprint of this chain. So we're well pretty much at the beginning and but also at the end and there's still a lot of well levers where we could tweak this chain to become more sustainable without really losing much of the experience that we value because well the most effective measure from our side as producers would be to produce bad content, so nobody watches it, but I think you can that that would need a concerted action to deter

people from TV once and for all. And that is something that we definitely do not want. Serious again. So next time we have a we have Lena Gieseke from was Professor of Creative Technologies at Film University Babelsberg, and she's researching on the impact of the carbon and environmental impact of the post production, film, post production, anything that's related to cloud computing in the production and post production process. If you have ticked the box in the Eventbrite link invitation or registration that you'd like to receive more notes or notifications from us, then you should get a note on the next event. Otherwise you maybe those who received the PDF invitation, there were all three links and so we hope to see you again. Please also spread the word. It's really open not only to the participating universities, so you can give it to friends, relatives and even to people you don't like if you think they should know about this. So it was good seeing you here, good to have you here Anette I hope the project will go along well. Maybe we can meet in a year or so to see what insights you got during your research would be a pleasure, so I wish you a nice afternoon and a calm evening.

Event 2 / Season 2

Event: Case study of awarded film "Alkibiades"

Date/ Time: 12.12.2023 | 15:30 – 17:00

The topic for the second event of the season is: good practice examples in film production.

Speakers:

- Project Lead of GEM – Prof. Dr. Björn Stockleben
  (Filmuniversity Babelsberg KONRAD WOLF, Germany)
- The carbon footprint of TV and streaming in Germany – Justin Janßen
- Green Producing for a TV-Show at HdM – Patricia Bek and Jana Halter
- Kopfkino green producing - Vivien Hoffmann & Maximilian Capeller

Curator and Moderator:

- Prof. Dr. Björn Stockleben (Filmuniversity Babelsberg KONRAD WOLF, Germany

Summary of the 2nd Event / Season 2

The session begins with introductions and swiftly moves into discussing case studies of good practices in university film production, focusing on Stuttgart Media University. The first presentation by Justin Janßen delves into the carbon footprint of TV and streaming in Germany, highlighting the comparison between linear television and video streaming in terms of energy consumption and carbon emissions. Through detailed research and modeling, Janßen provides insights into the efficiency and environmental impact of different broadcasting platforms, concluding with recommendations for reducing carbon footprints in TV distribution and viewing.

The second presentation by Patricia Bek & Jana Halter explores the challenges and achievements of implementing green production practices in a TV studio production. They emphasize the importance of assessing CO2 emissions, identifying hotspots, and implementing sustainable practices throughout the

production process. Despite facing obstacles such as budget limitations and university policies, they share valuable insights into promoting environmental conservation in media production.

The final presentation by Vivien Hoffmann & Maximilian Capeller showcases their project "KopfKino" and its green producing process. They outline their approach from pre-planning and target calculation through to the actual shooting and post-production analysis. By implementing sustainable practices and recommendations, they successfully reduce their CO2 emissions and provide learnings on the importance of communication, the use of CO2 calculators, and the impact of small productions on promoting sustainability.

Throughout the session, discussions emphasize the significance of incorporating sustainability into media production, highlighting the role of digital technologies, creative decision-making, and the challenges of balancing environmental goals with production demands. The session concludes with reflections on the broader implications of these case studies for promoting sustainability in the film and television industry.

Transcript of the 2nd Event / Season 2

00:01:29 Björn Stockleben
Hello. By your reaction I can say that you can hear me so.

00:01:38 Marta Materska-Samek
Yes, we can hear you. We are waiting for you, so we can start case studies of good practices in the university film production.

00:01:48 Björn Stockleben
Yeah.

00:01:49 Marta Materska-Samek
Hello everyone. The recording started. So the floor is your Björn and we can start. We will assist you.

00:02:00 Björn Stockleben
Thank you. Today we want to hear about student productions and good practice cases from the student production practice, especially at Stuttgart Media University. We also had a guest scheduled from Film University and she caught. So She's down with fever and cough and really not in the condition to join an online call. So unfortunately we have to postpone her part to another meeting. This has become a frequent phenomenon during this season of our lecture series, but I'm the more I'm happy that we have three projects. One will be introduced by video by Stuttgart Media University. We have here Justin Janβen with the carbon footprint of TV and streaming in Germany. Then Patrizia Big and Jana Halter with Green production for ATV show at Stuttgart Media University. And we have Vivian Hoffman and Maximian Cabella Green producing for a short film at Stuttgart Media University. And also in the call is Boris Michalski, Professor of Production at Stuttgart Media University.

I think we can we can start right away because usually in the 1st edition of each semester I would introduce the GEM Project. Project well can do what without slides. So the we have this initiated this lecture series as part of the Erasmus+ Project GEM Green Education in Media and we are looking at different perspectives of how to make our craft greener of filmmaking.
We realized that by becoming more and more digital, we actually are living in thriving digital worlds while sitting in concrete buildings and staring on screens. And we somehow want to change that, but we still want to make film. So how to reconcile that? That's one of the missions of the GEM Project and I'm very happy that you joined us today to shed some light on how to do that.
So then I would say that we start with Justin Janβen and the floor and the screen is yours.

00:04:56 Justin Janβen
All right. Thank you very much. Hope you can all hear me well. Give me just a second to start sharing my screen. This should do.
Hello, my name is Justin Janβen. And why we talk a lot about green production today or case studies, getting these contents to the viewers is also sort of carbon emissions. And that's why I'm going to tell you about the carbon footprint of TV and streaming in Germany. And this is more the distribution side of things.
Short introduction. I have just finished my master's thesis about six weeks ago at Stuttgart Media University, which I did in cooperation with KlimActiv. This is also the company, by the way, that developed the Green Shooting Calculator for film production that you may be familiar with. In my thesis I compared the energy consumption and carbon footprint of linear television versus video streaming. This is not a case study exactly, but it has been a university project in in some way, so I hope this fits in as well today. This work has also been part of the Green screening project. If you're interested in that, you can find out more about it on the website. So the objective in order to compare anything at all, I needed a functional unit in this case, it is one hour of viewing TV or streaming video. This unit is already well established for this kind of comparison. That's why I chose it as well.
Before we dive right in, I have some few abbreviations that will pop up in there, in my presentation just to take you. Just to bring up to date, OTT is, is over the top content which basically means video streaming. DTT is what we in Germany call antenna television. IPTV is any form of linear television via the Internet and CPE, customer premises, equipment, these are any kinds of boxes or amplifiers that you have in your home, any devices that you need in order to receive TV signals. That's that. So what do we know so far about the energy consumption and carbon emissions of television and video streaming? There have been a few studies that have been published on this topic. They all look at the carbon footprint of streaming and some compared to television as well. They all focus in different regions and not all of them include linear television. Those who do focus mostly on antenna or DTT. Only. the BBC compared multiple platforms as you can see here, and so did the Low Card Project as they included IPTV as well.
My aim is to compare all of the platforms including satellite and cable and IPTV. Why is that?
First of all, if we look at the BBC results from 2020 we can get an impression of how linear TV compares to streaming in terms of energy consumption and emissions. But keep in mind this is only for the UK and only for the BBC. I picked this one as an example here. The emissions depend on the carbon intensity of electricity generation or so-called National Grid Factors. For example, the grid factor of the UK is about 30% lower than in Germany because they have some nuclear energy and mostly burn gas instead of coal. Another thing

as you can see here is platform penetration. This I had to keep in mind and because it is very different in different countries. While in the UK settler and DTT antenna television is very popular with over 60% of households, you can see that here, in Germany it's rather unpopular, only around 6% of households. On the other hand, cable and satellite TV are dominant in Germany but play a minor role in other countries. So there's a different situation in from country to country and that has to be kept in mind. So to sum it up, why I did such a comparison myself. Firstly, often only one or two platforms were analyzed, maybe antenna, television, TTV platform penetration is different in Germany, so that must be taken into account. There have been massive efficiency gains in hardware energy consumption in the last couple of years, especially when it comes to standby mode. If you have ATV or set-top box and put it in standby mode, this will consume way less power than it did a couple of years before and there has been a shift in hardware usage. Nowadays we need less peripherals because their functionality has been integrated into modern TV's or smart TV's. Most of you probably don't need an XR receiver to get your satellite or cable TV signals, but you can just plug your cable into the TV itself.
What I did is basically APCF, which is a product card footprint with one hour of viewing or streaming as the product. And in order to do that, I had to define some system boundaries. And so some things that I included in my comparison and calculations and some things that I didn't include. Of course it's all the platforms, DTT, satellite TV, KVTIPTV and video streaming are over the top content. And for all of these platforms, I looked at transmission energy, CPE energy and peripherals and of course, the viewing devices, which are TV's, computers, laptops, tablets and smartphones.

00:11:31 Björn Stockleben
Just one question. Could you say again what CPE is?

00:11:35 Justin Janβen
CPE is customer premises equipment. This is any kind of amplifiers or antennas or anything, any boxes that you have in your basement or on your roof at home that you need to receive television signals.

00:11:48 Björn Stockleben
OK.

00:11:49 Justin Janβen
Or if you watch IPTV or if you video stream, this might be your Internet router. Some things that didn't include first of all content production and play out. I think we are going to hear a lot about content production later today and I have just looked at the distribution side. So content production was excluded. So were embodied emissions such as manufacturing, transport and end of life emissions. Also, I didn't include enabling effects, for example the emissions you could potentially save by streaming instead of driving somewhere to rent ADVD. These are enabling effects, but it did include these recorded content on a PDR to watch at a later time. And I also focused on households, private households, so I didn't include Public TV sets in bars, restaurants or hotels. Then I did a lot of research and modelling of all of these components on the left side and I modelled the energy consumption and I also considered demographics and viewing behaviour. How many hours do people watch television each day? I looked at the prevalence of hardware and households. How many people do have set-top boxes and what kind of televisions do they have? How big and stuff like that. I included standby allocation, so when devices are turned

off or in standby mode I accounted for that energy consumption as well. And for video streaming I used a so-called power model which was introduced by Jens Malmodin in 2020. This model takes into account that energy consumption is not proportional to the amount of data that is being transmitted, because in reality when more data is being transmitted, the energy consumption of a network for example increases only marginally and that not proportionally. So I used this model for the video streaming part of my calculations. Then I ran my calculations through some Python scripts and these were my results. We have the energy consumption of broadcast or television on the left and streaming on the right, and you see this grey area here, the grey bar. This is the viewing devices or broadcast. This means the television and it accounts for around 90% of total energy consumption for one hour of viewing television. The most notable differences are in transmission energy between satellite and antenna television, but overall they're pretty much in the same range over here. And when we have a look at the streaming site, for example here, the DTV bar on the streaming side, for example, if you watch Netflix on your smart TV for one hour, the energy consumption is virtually the same as watching linear television, but then the smaller the screen gets, the less energy is being consumed in total. If we take a look at the corresponding carbon emissions, the bars are basically the same, just the scale is different. To sum it up, for broadcast we have around 107-118 Watt hours per hour in energy consumption, which equivalents, which correlates to 40 to 45 grams of CO2 equivalent emissions. But keep in mind 100 Watt hours per hour, which is just the television set itself. So transmission energy and peripherals and so on have relatively low energy consumption. Streaming, I can say it's 4 to 118 Watt hours per hour, which is less than 5 to 45 grams of carbon emissions. But I have to say that the energy consumption here heavily depends on the viewing device the smaller, the less energy and the data rate, it does have a small impact when you're in fixed networks. So when you're at home in your Wi-Fi, it has a small impact. But if you're on the go in mobile networks, data rate does have a bigger impact. This is due to me using the power model approach as I mentioned earlier.

I have some conclusions. If we look at the different platforms, DTT is rather inefficient, because for example, in Germany we have about 150 transmitters or transmitter towers that use a lot of energy, but only 5% of the households actually receive DTT and the number of channels is very limited as well. There's only about 40 channels that you can watch, half of which are free and the other half is a paid subscription. And when it comes to cable TV, this is also rather inefficient because it uses a lot of bandwidth. Because all the TV channels are transmitted at any time, no matter which one you're currently watching or whatever you're watching at all, they are being transmitted anyway. That's costs a lot of energy consumption. Also, you probably have an amplifier that is always on, even if it's not used. Cable TV networks also are being used for cable Internet, so theoretically a transition to IPTV might happen in the future, which is a bit more bandwidth efficient. Yeah, Speaking of IPTV, this is relatively efficient because only the channel that you're currently watching is transmitted over the network and this saves a lot of bandwidth. It also has many future potentials. If you think of ultra high definition HDR video, personalized advertising and stuff like that, some of which is already in place today or available today. And last but not least, satellite TV. This is the most efficient one because one satellite or just a few satellites can reach hundreds of millions of homes. The bandwidth is sufficient for Ultra High Definition or HDR content, but one has to keep in mind that the embodied emissions can be quite high. If you think of rocket launches for satellite deployment, for example, this is a thing to consider. CPE devices - Most of the time they're inefficient because they are on our ways. They are consuming power 24 hours a day even if you're not watching any television.

So some kind of sleep mode would be great for that. That they only consume power when you're actually watching or using them.

When it comes to peripherals, they are hardly necessary anymore today, except maybe for IPTV. Most IPTV subscriptions need an extra set-top box, for example in Germany if you think of market tip power or Giga tip file. But these set of boxes have become very efficient anyway, especially when it's standby mode and that's about at least viewing devices. As I mentioned earlier, screen size matters, and so does brightness and panel technology. TV's have become a lot more efficient in the past couple of years, but they also have become bigger, so it still leaves a lot of energy. Mobile devices on the other hand are very small, so they are super efficient. And once again, data rate impact. There's no need to scale down every video that you screen on to 360 P or something. This won't save much energy except when you're on the mobile network. There it can, it can make a difference. I have some tips as well. I just resolution, screen size. You don't need to stream in 4K when you don't have a 4K display. For example, smartphones are almost never 4K displays. Same for HD televisions. Use equal mode or auto brightness on your television when it's dark outside. You don't have to turn up the brightness of your television, the full volume on to maximum setting. And the last one is think before you buy a new TV, you really need to buy a new TV, and if so, think of the right size. Many times people buy TV's that are too big for their living rooms, for example, that's something to consider as well.
All right, so one last thing. We have one problem with the calculation and comparison and that is it's all just average values. Or in my case it's mostly median values. And in order to calculate more accurate carbon emissions for specific viewing scenario, I developed a little carbon calculator tool for TV distribution and viewing. And I would like to show it to you now and feel free to try it out yourself later on or for example, calculate your own setup at home. You can find it under this link. I will switch over to the calculator. Hope you can see it now. This is it. We can choose some parameters or set some parameters here for a specific scenario. For example, let's say I have DTT which is antenna television at home and maybe I have an amplifier because the signal isn't strong enough. Maybe I have an old television and I do need an extra receiver for that. Then I have the resolution. I have to set this to HD because antenna television is only distributed in HD in Germany. I can choose my TV set by screen size or power consumption. I choose screen size, let's say our 55 inches. This could be a good start. This is basically the average screen size in Germany at the moment. I can choose if it's an SDR or HDR display or whether the content is SDR or HDR panel technology. Let's say I have an LED display and last but not least, I can choose my energy mix whether I use the national mix of Germany for example, or whether I have a renewable energy. Once I have set all the parameters I will get some results on the right. There's a table at the top and a graph at the bottom, and as you can see here, the energy consumption of the viewing device, which is the yellow area over here, is at about 77 Watt hours per hour, which is a bit lower than the average of 100 watts that I mentioned earlier. But this can change quickly once I change any of these settings. For example, if I have ATV that's not 55 inches but 56 inches 65 inches, sorry. The energy consumption of the TV itself rises to about 104 watts, which is 30 watts more. And then I can play around this. I can change any of these parameters. I can set it to renewable energy which will drastically reduce the emissions down here. And there's also an option to enter values manually if you know exactly what your devices power consumption is. For example, if you know I have 120 Watt television set, you can just enter that and it will factor this in here. And yes, and there's also calculations for the other platforms as well.
That's my little tool and that's it with my presentation.

00:25:19 Björn Stockleben
Very well. Thanks a lot. Let's give you a hand.

00:25:23 Justin Janβen
Thank you. Thank you very much.

00:25:25 Björn Stockleben
I must admit that I have a question numbers. That might not be the case for everyone, but I think your visualization was a very good example when so. Well, actually I thought, well I know that my TV set consumes some energy, yeah, and even a lot of. But to see the relation between the, the transmission, the energy used to consume for the transmission and for the viewing and that's very interesting because the question is who's in charge here, who has agency on changing something. And I thought the agency was more on the side of the broadcasters and the streamers, but actually we have a whole lot of leverage here to do something about the energy consumption. Well and even if you have a big TV turning the power the, the brightness down and having maybe inviting some friends to view together might good, might save a lot of energy. So and just to see that is already quite interesting apart from the detailed numbers, we have a question, but maybe if you want to add something to that right now, please do.

00:26:45 Justin Janβen
I mean, you're absolutely right. It's always the question who's held accountable for the energy consumption? Is it the TV channel or is it Netflix or is it ourselves without televisions at home? There are some things that we can do to minimize our footprint or to reduce our footprint. But the options are limited when you have a television set, you are not going to buy a new one if it's just one year over just to have a more efficient one or something like that.

00:27:23 Björn Stockleben
Well, given that buying a new one often includes buying a bigger, the efficiency effect is often void.

00:27:32 Justin Janβen
That's another question. Friend of mine is, is writing her thesis on the optimum distance between your television and yourself when watching and the best screen size. Because there's been a lot of debate on that. What is the perfect size for your living room? What is the perfect distance, viewing distance. Most of the time people buy televisions that are too big for their living rooms, and this could be something where we could say, OK, let's find out the perfect size for my situation, for my living room, and then this one might be even less carbon intensive.

00:28:17 Björn Stockleben
We have a question by Tuomo.

00:28:22 Tuomo Joronen
Hello. So this is not so a question as such, but I think it would be nice to have that QR code on screen for a while.

00:28:34 Justin Janβen
I can post the link into the chat. There's a chat. I don't know.

00:28:43 Björn Stockleben
Maybe if put it back on the screen for a couple of seconds. So if you share again because we don't have a public chat here as far as I know, yeah. So Please note down the link or use a QR code scanner to bookmark this. And you asked in the beginning that you were not quite sure whether this fits. Of course this fits. So a lot of participating universities in GEM Project are in from disciplines of film production, creative technologies, interactive media, immersive design and so on. So we are most more on the content creation side. But still I find it very important that we know that it's we're part of a machine of a larger system which also includes the distribution part which is often overlooked because we well we deliver our master file and then it's streamed. But it's really interesting also to see the difference between the transmission. So I would have for example I would have believed that that digital terrestrial television is more efficient than streaming and now you say it's not. So it's quite interesting because there was a lot of buzz about that, but a lot of effort to keep it up and do the digital switch over to terrestrial television, but it didn't so much work out while satellite television seems to still have a future after what you've just shown and a purpose. Well, does anybody have any further questions on that apart from where's the brightness button on my TV? OK, Well then thanks a lot. We are also in contact with RBB and for focus and I already heard from that project. So if you make progress in in any other I will you join KlimActiv as part of that project, so you will be with that project for quite a while. So maybe when we make an update on that project in a year's time or so we'll invite you again. So it would be nice and great idea for Master's thesis. Congrats.

00:31:18 Justin Janβen
Thank you.

00:31:20 Björn Stockleben
You now Patricia Bek and Jana Halter, They can't be with us today but send us a video presentation. So we do the video in between and then we go to real life people again with Vivian and Maximilian. But I think it's good to watch the video right now. I will share the video.

00:33:30 Patricia Bek & Jana Halter
Hello everyone. We are Patricia and Jana, currently in our fifth semester studying Audio Visual Media at HdM. Unfortunately, due to our internships, we couldn't be here in person today, so we've prepared this video presentation for you. As an integral part of our academic studies, last semester we were involved in a team project dedicated to producing a television show from start to finish. Our program, Audiovisual Media, offers a range of six studio productions, including TV, film, visual effects and many more. Simultaneously, we enrolled in the Green Producing module, which focuses on incorporating sustainable practices into media production. As a result, Patricia and I were tasked with overseeing the production of our TV show with the aim of making it more environmentally friendly and ultimately creating a comprehensive project closure report. Today we would like to walk you through our closure report covering the background and requirements, implementation and results and achievements of our green production initiative throughout this report. So just a quick recap of the TV show itself. We took on a challenge of producing a show from pre production to live broadcast in just one semester.

Our show was centred on the queer community and the contemporary challenges they encounter in every aspect of their life. We were particularly interested in exploring the level of acceptance for queer individuals in our society and had the privilege of welcoming 5 Queer talk show guests and a queer female band for musical support. Our green producing project for the TV Studio production initially posed a challenge, as ecological standards primarily focus on films and less on TV shows. However, the fundamental principles of environmental preservation and sustainable production practices are applicable across industries. Therefore, we chose to use the Green Motion Guide as a starting point and tailored it to the specific requirements of our TV studio production.
Furthermore, we encountered some gaps in information required for a comprehensive assessment and analysis of certain environmental impacts of the studio productions. For example, a system for measuring the electricity consumption in our studio was lacking. Additionally, other factors such as the university sourcing of electricity from non renewable sources and predefined waste disposal methods were beyond our control.
Our primary goal was to assess the feasibility of obtaining the green motion level for our TV studio production. Although we didn't officially submit for certification, our aim was to determine whether our project met the criteria. Furthermore, we strive to create a pioneering template for future cream producing reports in the realm of TV studio production. Another significant objective was to raise awareness about Environmental Conservation among project participants and stakeholders, including talk show guest and viewers during broadcast. We wanted to focus on sustainability, promote eco conscious decision making and encourage the adoption of greener practices. Our commitment was to create a more environmentally friendly production and actively contribute to the reduction of CO2 emissions.
In the beginning, we created a preliminary CO2 balance to discern the primary sources of carbon dioxide utilization within our production. Our concerted efforts within directed towards these hotspots implementing measures to reduce CO2 emissions. The most prominent hotspots we identified pertain to energy consumption and transportation. Throughout the project, we actively engaged the entire team and provided guidance on sustainable production practices. We created comprehensive tables that collected various data such as travel to production meetings and the TV studio, the use of technical equipment like laptops, and other relevant information. Some of the initiatives we introduced during the production included precise electricity consumption, tracking software team involved tracking tables, separate waste disposal containers, exclusively vegetarian and vegan catering, motivation and encouragement for the use of public transportation, elimination of single used items and a shift from elaborate set of signs to impressive energy efficient lighting technology.
In the end, we conducted a follow up CO2 balance to provide an overview of the actual CO2 emissions from our TV stereo production calculated after the productions conclusion. Despite our dedicated efforts to reduce the ecological impact of our TV studio production and promote sustainable practices, we encountered significant challenges. Regrettably, we were unable to attain the green motion label and our actual CO2 emissions exceeded our initial estimates. We attribute the CO2 emissions discrepancy to various challenges, including the initial lack of a precise method to measure studio electricity consumption. Only at the latest stage in the project did we establish a precise tracking system which unveiled elevated real time consumption figures. We also faced challenges due to university policies, including to use of non renewable energy and transportation choices like a van. Additionally, issues related to waste disposal and paper use were hurdles. Budget limitations further complicated our ability to invest in green alternatives,

underscoring the delicate balance between the sustainability and financial constraints. In total, our experience demonstrates that implementing green producing is a complex endeavour that requires not only technical know how, but also close collaboration and adaptability. Despite the obstacles, we gained valuable insights into implementing sustainable practices that can serve as a guide for future projects.
We hope that our experiences and insights can be valuable for future project support and address challenges arising from university related changes. Together, we can make a positive contribution to a sustainable future.

00:40:26 Björn Stockleben
I did like that. That was very fresh and interesting to see it from the side of the live TV production because we often look at film productions but there are some things they have in common and dedicated challenges. I would say that probably the energy consumption in a live TV production is maybe even easier to track once you have the mechanisms in place because you have a very fixed time when you run the event. So and you don't have a large post production and decentral processing. There were some parallels of like the catering. She mentioned that sometimes money was not available to procure more environmentally friendly solutions. And in some cases you have to invest a bit to be more environmentally friendly. But in other cases actually the environmental friendly choice is also the cheaper choice, for example with the vegan buffet. So the experience of some of my students is that actually the vegan buffet, the vegan option is always the cheapest and they could cook very decent meals on quite a few bucks and making. Even I know that some people can't stand eat vegan over a week or so, so during especially if they have to work the whole day. But making vegan the standard and any other vegetarian or meat option for those who really have to have it is an easy way to really save money. So it's just an example. So I'm also often wonder what makes it more, what makes it cheaper. So where is environmentally friendly measures where are they cheaper right away and where do I have to invest? And then it might get cheaper for example if you have reusable capsule. So that's something that where you have to invest if your university doesn't have it and well that's another thing that the university restrictions that were mentioned or if I'm not mistaken also at Film University we can't decide which energy source to use. We cannot say, OK, we switched to green energy because it's the state of Brandenburg who decides which contract to use. And as far as I know currently we're not on green energy. If anybody knows differently than please tell me I'm wrong. But I think that's the status right now and that's I think that's with a lot of public German universities and that is something where, we should really make a change and try to lobby with the industries with their respective responsible people to change that because that would actually be an easy choice. Well, I don't know whether it's easy to implement that or not, but it's something obvious to do. So are there any comments on that people, well something where you say, well I can relate to that or where you just have something else to add from the domain of TV shows before we go on to the next presentation. Well, I got one more thing. I noticed there was a very little material used. That is when we do shows, we don't do shows often at Film University but often we have a quite elaborate setting for the studio and the decorations takes quite some effort to do and it's thrown away right after the shoot. And using sustainable material or reused recycled materials, alternative materials to build these sets is something that our students have been looking into. And although it's still a pity that you throw away all this after shooting, you can significantly decrease your carbon impact by experimenting with reusable or recycled materials that for example, using a special cardboard, which is very light cardboard structures instead of wood for example, and all that.

Yeah, but before I tell you all I can comes to when it comes to my mind to the aspect of TV shows which I really like. I would like to go on to the next presentation and I already see Vivian and Maximilian with Green producing for a short film. So please your mic.

00:45:58 Vivien Hoffmann & Maximilian Capeller
Yes, thank you. I will try to share my screen.
We also want to show you guys our final movies so we have to quickly check if the sound is doing well and if not I can show you the video instead.

00:47:01 Björn Stockleben
I didn't hear sound so you have to check it when you do the screen sharing in the dialogue to the right. In the right top corner there's a switch you have to click before you go on with sharing and if you can click that then I can also help you because I just found it out myself.

00:47:26 Vivien Hoffmann & Maximilian Capeller
I have actually nothing to click because it's just a web browser. As we don't use Microsoft Teams at the university, I don't have to.

00:47:41 Björn Stockleben
If you could send me the link if that would be OK and I can screen it for my.

00:47:54 Vivien Hoffmann & Maximilian Capeller
Or maybe I can try it. I'll have this on my. Let me just check this. Let's see is this working? Can you hear anything?
Share it again. Yeah, so sorry for the delay. So you see everything? Great. Then I will start.
So hello again. We wanted to present you our project KopfKino and it's screen producing process today. I'm Vivien. I finished my master studies in corporate communication this year with the focus on film production, and I was one of the green consultants of our project together with Max.
Yes, that's me, Maximilian Capeller. I also worked on the project. I'm doing my bachelor right now at HTM and with focus on film production in the auditor media program. So I guess we will see the video without audio, but we will just start and show you a quick yeah way where you can see the final project. So we have the imagination. It's basically an ad for cinema. So we'll just see. I mean it's quite laggy for me at least. So I think it's online as well just search for KopfKino HDM, it's quite nice advertising short film about the imagination and the effect of cinema for the audience sort of a hero journey.
I mean now the people know they can look it up. It's not much dialogue or something. I think everyone has like a sort of pictures in their mind how it went. Maybe I'll just continue with the outline of our quick talk.
We will start by pre planning then going a bit through the target calculation we did with the CO2 calculator. And then there we had some determination of the hotspots, which leads to recommendations for the shooting. And we'll have a quick look at the actual calculation and the shooting and the analysis and then we will round up with some learnings. I will just give it up to Vivian for the first topic.
The first topic is the pre planning. As you might have seen in parts in the video, there have been some obvious challenging points for sustainability. One was the scene with the ocean, which has been actually deleted from the script, not only because of sustainability problems, but we wanted to mention it here because actually the script is already the first

point where the consulting and optimization process starts, because there you can already delete some things.
The second one is the sand needed as production material for the desert, and we decided to reuse it to avoid waste. So we decided to store it in the use of in the university or for future productions, or to use it to build new sandbags for shootings. And last but not least, the obvious point is the jungle. We decided, for example, to borrow the plants from local garden center close to the universities, so the delivery of the plants didn't cause lots of emissions either due to the short distance and of course the plants could be reused. And then in the pre planning we had meetings from an early stage on with production and direction to ensure that they were informed and that we all had the same goals like. It was also useful to give them a first overview over the free motion standards, possible measures and our involvement during the shooting as well as for them to explain us the script and to ask any questions. And from that point on, we had like a permanent communication with the head departments later on as well, an e-mail for example, with detailed information and recommendations specified for each department. After that we only communicated with the production as intermediate communicator. So we avoided any confusion by talking to many different people. And last but not least, the collecting's of CO2 relevant data since the beginning, which was really important. For example, we as provided as well, like the two before of us, a table of distances and current consumption for the crew to fill. For example, from the beginning they had to fill how many hours they used which laptop or which device and they filled in the distances of any journeys. So that was important. So nothing has been forgotten and it had there had time to fill it out and we're reminded each weekly by the producer. And then we already go on to the target calculation. We use the MFG-CO2 calculator and we have like on the left you can see an outtake from our final report with the main sections of sustainability like energy, travel and transport, catering and the use of material. So here the chart for each order for target and actual are still the same as we till this point only had the data for the target calculation. So in total we had an estimated amount of 4635.11 kilograms CO2. And for this calculation or estimation, we collected like each little expected CO2 emission in every step of the production, any rides, use of material, electricity, heating emissions and so on, and collaborated therefore with the producer who gave us some estimated numbers, as he already knew before the happening, let's say like this, and before any rides where things were borrowed from which journeys had to be done, who was when on the set. And so the collaboration with the producer was really necessary and useful to collect any kind of kilometres and journeys. And here that led us to our first estimated results with which gave us a possibility to detect further hotspots and optimization potential, which leads me to our next slide. For example we have the catering F1 of our hotspots regarding for example to the high percentage in comparison to the total amount of CO2 emissions. Catering was still like on the top and another hotspot was the commute of the main actress where a local actress or maybe a stay at a eco friendly hotel would have been or would have saved at least some carbon. This wasn't possible as it was like a non budget project from student production which is the same with the undulatory current in studio which we has already been mentioned before like our university has like just the undulatory current. So there was no opportunity to change that by the students. But nevertheless, we had some recommendations for optimize or minimize the CO2 emissions further And there were for example, we recommended to have two veggie days instead of one as it reduces more like the catering emissions that we have or that were relatively high in our production. Another one was the labelling of the bottles so they didn't need extra caps or even the dishwasher and a detailed waste separation as the one of our university was not optimal as well. And last but not least, we

ensured a permanent feedback with the producer to answer like questions, give further instructions and keep each other just up to date during the shooting, which Max will explain now a bit more detailed.
Our job is there at the actual shooting, most like basically visiting the set during production, controlling, answering questions, monitoring and just recording all the data. By the way, this is actually not the most time consuming part, so you didn't have to be on set all day. And after this after you have all the exact data, it's basically the same procedure as the target calculation. Now we have actual data, so for example you have exact current data which is shown on the next slide and then you also have like sort of for example a trip list. We have exact mileage, quick, quick example for the current data. In our film studio it was pretty convenient to track the current data because all of the power in our studios is coming through one device and we can track it there. And then there comes the final evaluation report on the analysis. We were checking all points determined from the MFG. This is the company who the CO2 calculator and the labels from and we checked everything that was necessary to obtain the green motion label in theory because we're just like not professionals. We're not professionals on this topic. And we just check whether the criteria has been fulfilled and if not why not. And I'm argued a bit about the causes and stuff. Of course there were points that could have been improved like for example the local actress was not possible which sort of did a bit of master our CO2 calculation and the green electricity we talked about this in our university, it is as well just like mixed currents also not really environmental friendly, but in the end we theoretically achieved the label. Our final CO2 calculation is 2956 kilograms, which is almost one ton less than expected. And then I will just give you a quick overview about our learning things. First of all, communication is essential, especially before, but also during and after the shooting. And to get all the data easily. For example, we recommend extra spreadsheets for monitoring and tracking, because there you have like this interactive a tool via a cloud where every crew member can just easily type in his rights. We also have some feedback for the CO2 calculator from the MFG. It's a quite new tool to calculate and it's great and saves a lot of time, but it can improve in some points. For example, there was no option to enter saved food in the calculation. We worked with a bakery who gave their like last days and riches and stuff for us. So it's like an argumentation how you should count the fruit would have been thrown away anyway.
And lastly, it's important to keep the crew up to date to motivating factors to values even after the shoot. For example, we used weekly sheets for this. In conclusion, such a small production will like not and make a huge difference in the worldwide CO2 consumption, I think. But sustainability is just too important and too easy. Not occluded on that and it takes a lot of time, but it's quite simpler than you're thinking. It's actually a lot of fun in the end and perhaps it can inspire a change in the people's thinking. So we thank you for your attention.
Yes, thank you. And we hope you could take some things away from our presentation. And if there are any more questions, please go ahead.

01:04:32 Björn Stockleben
Thanks a lot. While we're waiting for questions, please raise your virtual hand if you have a question. One question for you from me. So you're all studying the same program but when you're going into a to make a film so you spread into department roles and I could imagine well in the beginning everybody's eager, we're doing green shooting. But then it might happen that you become consumed in your department roles and act differently by the role you're in. Did you experience that or was that not an issue?

01:05:16 Vivien Hoffmann & Maximilian Capeller
Yeah, of course. Not everybody is like super motivated to put like the CO2 values at their first priority. And of course, you have to always find a compromise between the creative aspect and the CO2 or the environmental stuff. At this point it was or we had the pleasure to work with a very good producer on this project who was very good at communication and we didn't had any like serious discussion points. So it was quite simple and easy for us to implement the stuff needed to for the staff who won't like restrict a lot of creativity but also like get the production on a good CO2 point.
I think it's like when the heads departments are like in the boat like we say like they're on the on the same page that they also wanted to save like emissions and they want to get the label. They are enough motivated to get it through to the rest of the team. And so there is no one who comes up and says so I'm, I don't have, I'm not feeling like it today. So they're all like doing just because they agreed to do it. I think therefore the early meeting is so important because then you already give a good overview of what it means and of course that it means also some extra work. But then everyone knows in the from the beginning and it's not like shocked at some point of the shooting that they have to do like 3 hours extra work.
I think also like every or a lot of students at our university including professors are very progressive in thinking and like for a studio production like this, it's not super special to do the CO2 calculation everything. So it's like included in mostly every production at HDM.

01:07:30 Björn Stockleben
And one question that. I find relevant for student productions is because, well, usually you always have too few hands to get the production done. So it's really a question of can you afford of having people separate? Well, setting aside a person, we need to do the green consulting and just take care of that. So how was that in your project? Which role or roles did you have? Were you exclusively for this the green consultant job there in the project and how large was the team as a whole?

01:08:12 Vivien Hoffmann & Maximilian Capeller
But actually we were like external green consultants. So we visited the lecture green consultant at the HDM and then we're sort of mixed with the studio production, which is a completely different lecture. And therefore it's true there are a lot or there are not enough people on set especially in the small teams like we were like 12 or something. There was not one person from the team doing consultants. So it was a good collaboration and this is how we can make these three consultants even in the small team.
And I think it was really useful that there is some objective parts who can like tell it from an objective point to each department because it's more easy I think than if you're from one department and telling other departments what to do. So as we had in like kind of objective role and we're communicating mainly with the producer later on and gave like specified information for each department, but they could like choose what of that stuff that we or the input that we gave which they could use for the production or which wasn't useful in their case.
I mean, it's a green consultant. You consult things. It's not like you say this, you have to do this or you have to do that. But in the end, we're like counting every points together and then decide whether or not the green motion label is achieved or not and they did.

01:09:52 Björn Stockleben
Yeah, great. Just considering whether this could be a recommendation that in this case two different courses at universities kind of work together and you were not part of the project so and so I'm just thinking about how this could be realized in other settings for example at film university, but the general idea of having people as green consultants who are who don't have really stakes in the project as such might be a very good hint because if you're involved in the project even if you are set aside for this job exclusively in the beginning when they're short of help you might get sucked in and end up doing totally other tasks. So this seems to be a good concept and seem to have quite worked quite well.

01:11:04 Vivien Hoffmann & Maximilian Capeller
I think it's very important to have like this neutral role to not. If you have to find compromises it's very hard to for example be in a creative and a CO 2 part as well or an environmental part. And one thing I want to add is if you do the CO2 calculation once and go through the whole process like from now on and every on any of my productions, I will probably do some rough CO2 calculation. It's like if you do it once, it's very like it, it's not that hard, it's very simple, but you will just have it in your the back of your head. And yeah, I think also a lot of our crew did this as well. And so it's not an invest in the particular production because I mean like 3 free tons of CO2 is not that much compared to other but it's like it's start of changing the people's mind and that's I think that's the main good point of it. Well, I think it's still an amount that we save like.

01:12:12 Björn Stockleben
We had this question a while ago in in the last semester. The general CO2 impact of the film production as a whole is nothing compared with like the global building industry or construction industry. But actually it doesn't matter how much you save, it's about how much can you save from what you actually consume for this very activity. And so there's it's twofold. One thing is, well, every bit counts and if you can save 30% with your production, you should do that. It's 30%, even if it's three tons or so. I don't know. And the other thing is of course what Vivian said, it's about the mindset of people that if you're aware of this in the small production, you will be aware of this. In the large production you will be aware of this aside from productions. Well, maybe if you buy your new TV and you think, Oh yeah, actually I could save 30% energy consumption if I take the 55 inch display instead of the 65. 55 is still insanely huge for me because I'm still at 32 there I'm doing quite good. Not so in other realms, but there. Well, my TV set is small, yeah. So just saying, it's this work. It's not about the amount we save. It's really about the pervasiveness that we try to save energy wherever and whatever we do.

01:14:05 Vivien Hoffmann & Maximilian Capeller
I just think it's also like with the student production, you don't or you don't see a lot of points which we, for example, didn't have, but which you can like save in other productions. Like we didn't have of course any flights, we didn't have any diesel generators or anything like that because we just produced in studio. But these are things that make like a huge difference in bigger productions for example, which can like easily save a lot of emissions.

01:14:36 Björn Stockleben
But that was a very good insight in your process and a successful project. Does anybody have some last questions?

01:15:06 Vivien Hoffmann & Maximilian Capeller
I mean just thank you for the invitation. This was interesting to talk.

01:15:17 Björn Stockleben
OK. So thank you, it remains thanks a lot for your presentation and your the charming talk. So we have one more presentation in this series, not today but in the series will also continue in springtime with three new lectures but as last, the last lecture by Lena Gieseke on the energy consumption and implications of post production had to be cancelled due to of it. We decided to still hold that in the winter term and it will be on November, not November, on January 9th, Tuesday, January 9, same time. And if you follow us on Eventbrite, you will receive a notification. I think we still didn't quite figure out, but maybe I'm talking. I'm speaking for myself. I think Sophie knows a lot more about Eventbrite.

01:16:28 Sophie Tummescheit
I think everyone who was registered for the event got an e-mail yesterday. I hope so, at least.

01:16:37 Björn Stockleben
OK, yeah. And if not, well, you can reach us via the GEM website. You have to Google that film. You have to look for what was it? Kopfkino HDM? Kopfkino. HDM. Well, it's German. I don't know. I would like to write it in the chat, but somehow I can't. KOPFKINO and HDM. Those are the letters. Well, hope one or the other one. Got it.
So, yeah, all right.
Thank you. Thanks to all of you and I wish you a nice evening and a nice Christmas time. And I hope that we meet each other again on January 9th for Lena's talk on energy or on sustainability in post production.

Event 3 / Season 2

Environmental Impact of Digital Media Distribution

Date/ Time: 09.01.2024 | 15:30 – 17:00

The third meeting of this season of events is dedicated to Sustainability in VFX, and is curated by prof. dr Björn Stockleben from Filmuniversität Babelsberg KONRAD WOLF.

Speakers:

- Sustainability in VFX – Prof. dr. Lena Gieseke (Filmuniversity Babelsberg KONRAD WOLF, Germany)

Curator and Moderator:

- Prof. Dr. Björn Stockleben (Filmuniversity Babelsberg KONRAD WOLF, Germany

Summary of the 3rd Event / Season 2

The presentation by Lena Gieseke, a Professor at the Film University in Potsdam Babelsberg, delves into the intersection of visual media technologies and sustainability within creative media production, with a focus on VFX and post-production. Gieseke's research targets the development of sustainable IT systems, including "clean IT" initiatives, which aim to minimize environmental impacts within the visual effects and post-production sectors of the film industry. She emphasizes the critical need for

sustainability in media production, outlining the key areas of concern such as energy consumption, waste reduction, and the overall carbon footprint of production processes.

Gieseke introduces the concepts of "green" and "clean" production, explaining their definitions and the importance of adopting practices that reduce environmental impact. She provides current statistics on the carbon footprint of film productions, illustrating the significant variance based on the scale of the production. Gieseke highlights various initiatives and standards aimed at promoting sustainability within the industry, including the Sustainable Production Alliance and Green Shooting guidelines. Despite these efforts, she points out the challenges in fully implementing these guidelines, as evidenced by low adherence rates among productions.

The discussion further explores the specific contributions of VFX and post-production to a production's overall carbon footprint, noting that while these areas may account for a smaller percentage of total emissions, their impact varies greatly depending on the project. Gieseke stresses the limitations of current CO2 calculators, which often fail to account for the full lifecycle of production equipment, including manufacturing and disposal processes. She calls for a more comprehensive approach to assessing the sustainability of visual effects production, one that includes consideration of the energy sources used and the environmental costs of hardware manufacturing.

In addressing questions from the audience, Gieseke acknowledges the complexities of achieving sustainability in VFX and IT, underscoring the nascent state of research in this area and the need for industry-wide collaboration to develop more effective strategies. She encourages ongoing dialogue and exploration of innovative solutions to reduce the environmental impact of film production, emphasizing the role of individual and collective action in driving change towards a more sustainable future in the creative media industry.

Transcript of the 3rd Event / Season 2

00:00:02 Marta Materska-Samek
Now we have the third of three meetings which started this autumn and we will, invite you also for the spring season next term next semester**.** But this is our last meeting this this semester, so the floor is yours Lena, please tell us something about you and and you can share the screen**.**

00:00:33 Lena Gieseke
You thank you Mata for the introduction. So hi, I'm Lena. I'm a Professor here at the Film University in Potsdam Babelsberg. I'm part of the Creative Technologies Group and my professorship is Visual Media Technologies or Image Based Media Technologies. So it's pretty much media computer science, but of course in a very artistic, creative context such as the Film University. And yes, so sustainability or sustainable creative media production is one of my research areas. I've been working on it quite intensely for over a year now in different projects and one of the areas is IT systems or like clean IT, which of course is also VFX or post production. Is is part of that And also I wanted to say apologies for not showing up last time for everybody who wanted to attend in December I got quite sick and I was believing all morning I could make it. But then doing lunch my fever was just spiking. So sorry for that short minute cancellation. So without any furthe I do, let me start my presentation.
In this talk as I've already mentioned, Marta has already introduced. So the focus is on VFX and post production or as I already said IT systems. It will be a very, I would say also academic but also hopefully intuitive presentation. I'm spending a whole spectrum of topics, of course always with the goal of a green future and a green future just as like a nice start, I asked an AI to visualize a green future or a green desirable future and this is one of the versions how it could look like. And with that image I have my mandatory mentioning of AI done so we can move on to sustainability in VFX. My presentation of today, so what I will cover is a clarification of terms such as green and clean and so on.

This might be maybe a little bit redundant to you, but then again, I really like to start with these basics one more time so that everybody is really aware of what's going on and what we're talking about. And then I will go over to current numbers and activities in film production with one example of the VFX department. But then based on that what is currently going on, I will present to you maybe a little bit a harsh reality check with some actual computations that are needed. We will see what that means. So let's very briefly reconsider what is actually mean when we talk about green and clean and sustainable and these kind of things. You hear a lot like green production, green film production. So I think that's quite straightforward. So with green we mean processes and products with the low end environmental impact, so meaning with having as little impact on to our ecosystem as possible**.** And for example, if we talk about green production or greening a production, a definition is the basic principles behind greening a production include conserving fuel and energy and avoiding toxins and pollution, saving water, reducing plastic and preventing landfill waste. So why I like to mention it here is really to show one more time there are so many dimentions to this problem. So of course and I will come back to CO2 and I will explain to you why. But they are also toxins saving water plastics and all these things and what you might have had in terms of VFX and IT is also the terminology of calling something clean. So clean originally was used for sustainable energy sources. So energy coming from non-fossil renewable energy sources like wind or sun. So originally that's where that term come from. But in the context of VFX and IT so you often hear clean IT, it means that or it's usually used as IT with low energy consumption. And here the idea is that we are going more and more into the development of technologies that are sustainable by design. So the idea here, for example clean IT research is really targeting that the software already. Like when we write the software let's say 3D software for VFX or compositing software that already by writing the software, the coding we try to make the software as sustainable as possible. And the main factor here is still like the low energy consumption, just to give you a brief intro these different aspects and why the whole thing. And once again this is no news but I like to mention it over and over again. What is the problem? I said there are various problems but the main problem as of now is the global warming of our of our atmosphere. So in this global or this warming of our atmosphere is based on the emission, our emission of greenhouse gases coming for example from fuel and non clean energy sources but also from certain agricultural processes. We have the problem that we emit a lot of carbon dioxide, CO2, there are other greenhouse gases. So that's why you have sometimes the E for equivalence behind that and by doing so we warm up our atmosphere. And so if we continue to live like we live now, like emission emitting the CO2 gases that we are emitting. So we are heading towards an increase of temperature between four and five degrees. If we are, if we are continuing like we are currently continuing, so no changes, we are heading towards 2 to 3°. And if we are implementing and we are almost already failing that, we are heading towards 2° of temperature increase. And I like to give you the example that this is quite fitting, because last time I couldn't give the talk because I had a fever. Imagine how you as a human being feel like having a fever. So if you have a fever of let's say 38° that's of course not life threatening, but already quite limiting. And by the way, so for example in December I had like 38.6 and I was like no way I'm giving a talk like I'm out of here. So and we are heading towards the future where our Earth is, is, is operating in a way as if and of course it's not the same but as if we are have to operate with 38 to 39° of fever. So here we are really heading into a future which is not good. It is as if we are heading into a future where our planet has constantly between 38 and 39° of fever. And I'm not saying we are having them constantly, it's just an analogy and I like to paint the picture like this. OK, so that's the problem. And that's beyond all the different aspects that I have mentioned CO2 emission is still like a really dominant or maybe even the dominant aspect. And for that, for our CO2 emission, I also like to give you or it makes a little bit easier to also have this intuitive quantification, especially when we talk about how much does VFX for example need. So usually or you probably already also know that we often talk as measurement as one ton of CO2. So what can we understand as one ton of CO2 intuitively. So this is a very much an average or like oversimplification, but you probably know or you might know maybe not, then that's of course fine. One flight 1 intercontinental flight between Paris and New York is 1 ton of CO2 emissions. So you are causing one ton of CO2 emission. The annual compute consumption of an average

household is only one 0.65 tons. So with flying across country, across continents, you are causing more than an average household of CO2 emission. Again very over simplifications, they have caused very different households. So I'm just giving like a little bit of a feeling for where we are at. Similarly, a year of a gasoline car is 0.5 tons. Sorry, so one ton, so half a ton is sorry so 0.51 ton is half a year of gas and one year of electric car usage. Apologies I was I was confusing myself there also again a very over generalization but just to give you a couple of ideas for example you there are also some studies or some numbers that say 1 ton of CO2 is roughly 140 meat dishes and 2000 vegetarian dishes. Again, over simplification, there can be a big Schnitzel and there can be a small and there can be like sustainable meat production and non sustainable but just these numbers and they're all based on something. So I didn't make them up. And to be honest, which is also interesting, there are a lot of studies that compute or investigate the damages caused by CO2 emission. And so roughly speaking that is a number from a German from a German ministry saying OK, the emission of 1 ton of CO2 amounts to damages approximately of €180. By the way, there are also this calculation in terms of deaths, human deaths. I spare you those at this point. And also what I really like as a feeling or as a comparison to absorb 1 ton of CO2. So if we emit 1 ton of CO2, let's say, by flying from Berlin to New York, 50 trees must grow for one year to absorb that emission. So that's good news and bad news. We have the trees, they are doing the work for us, but for one ton we need 50 trees to grow. So they are also need to be in the process of growing. Just to give you like when we talk about CO2 tons in the following that you know a little bit where we are in terms of comparison damages and so on. And you of course know or you have heard of the CO2 footprint. So this is a very valuable and meaningful measurement. So for example, you do something and then you compute the total amount of CO2 that is emitted by that action and that is generally used as or understood as CO2 footprint. And it is a really also a valuable feature potentially in an economic context. So I personally believe and hope that we are heading towards a future where we don't only invoice the money. So currently if we do something, you get an invoice, it tells you how much it costs in terms of money. I could imagine that we are heading towards the future where we have the cost of money and the cost of CO2 that would be nice in my opinion. But it's also very difficult because this computations are still so difficult. So the correct determination here and you will see in a second an example for that is still very, very difficult however, which is also it may be a fun fact or not so fun fact and we see with that also the complexity of these approaches. Actually the term CO2 footprint became popular through a 100 million marketing campaign by BP. So one of the oil and gas, one of the biggest oil and gas companies, so one of the dirtiest companies you can imagine. They actually pushed advertisement companies beginning of the 2000. So it was, sorry, let me check it was 2004 to 2006 where they say what on earth is a carbon footprint as one of the advertisements and they say reduce your carbon footprint. So the attention here was to deflect all the responsibilities into a personal space. So I'm not saying so CO2 footprint is still a good thing to calculate, but it is kind of interesting where it's coming from. Let's say it like this. In general I also want to introduce on want to mention in the beginning of course the topic of green washing. They're very fine lines. We will see that with the current computations of CO2 but Oval idea of course you can also say talk clean, act dirty. And this is a big problem in our times currently still like these marketings and like a selling and so on. The problem is here that there are really few standards and there's almost nothing legally binding in terms of measurements of values and we have a problem with images and symbols coming back to our non so friends at BP. Look at their logo. I mean they are trying to brainwash us here thinking that BP is really, really green or you see a lot that for example an advertisement that they try to offer something at the solution which is just not relevant. So for example, Exxon, another oil and gas company with coal and so on. They had an advertisement campaign that said let's use algae. Do I say that correctly? Like the tiny greens things in the ocean, like the algae's? Is that how you pronounce it? OK, Mata's sneaking, so that's good. So they said, hey, let's look, it's tiny, it's green and could be the future of biofuels. And there was no real scientific evidence or significance that this would be a relevant thing for us. But they made a big advertisement out of it. So of course CO2 compensation is better than nothing. But it's maybe not the only solution out there. Let's say it like this. Green washing is a problem and the lines are fine, like where are we? Because the actual values are really hard to find

and control. And what I guess my message here really is for now is be careful, be attentive, look out for like a little bit like these brainwashing things also on products. And we as maybe as content creators or even maybe companies or startups, we really just have to be truthfully sustainable and what we do. So we need here transparency and accountability. We need different kinds of approaches and of course we still need to stay close to reality. And these are obviously very difficult questions. And now we know we are at what problems are and so on. Let's move into looking at current numbers and activities where we at this film production, let's start with that you probably I could imagine have already some heard about this. So what I can really recommend is a nice report from the Sustainable Production Alliance in North America, the US where all not all many big players like Disney, Fox, NBC, Netflix, Amazon, they all participate in in this alliance and they have a lot of numbers and studies and for example this report shows the some numbers for the average CO2 emission of films. And they differentiate here between like the blockbuster called the 10 pulled on the left side moving to large, medium and small productions. So in Europe they are probably in the area of the small production, maybe with a couple of medium, I don't know. But so of course the blockbusters is something a little bit less frequent for us. And So what they say or what they show is that film productions range from 3000 tons for the blockbusters to around 400 tons for the small production, so 3000 tons. So now you can think, OK, it's approximately like 3000 flights from Berlin to New York, it's 1500 emission cars per year. I'm not saying which is better or worse, but there you have a little bit of a comparison and to go maybe even smaller. So let's have a look. So at our school, Film University in Potsdam, Germany, we actually are very active with production. So we have up to 100 productions per year, I would call them mini productions. I don't know, I don't have any actual measurements as of now, we are working on that, but so I said these production have probably between 5 to 10 tons or maybe even just 1 to 10 tons depending of if there's travelling or so on. But this means that even we as just the Film School have approximately up to 1000 tons CO2 emission per year just by our production. And that means painting the picture even a little bit more intuitive or dramatic we had. We need just Film University needs between 25,000 and 50,000 growing trees for an absorption of our CO2 production. These numbers are a little bit fishy. So don't quote me on that, but just an over let, let it be 10,000 trees per year, it's still a lot, yes. And so that's where we are in film production and there are thankfully a lot of activities for sustainability. So similarly starting in North America, we have the Green production guide where they give you a lot of insights. So for example saying so it's by film industry leaders and they offer tools, resources and vendors for reducing your environmental impact. So it's really good, but it comes with a lot of also limits. Similarly, we have for example in Italy Green Film as film group. They also come published guidelines. In Germany we have Green Shooting guidelines. So there's a lot of happening, but I would argue there's still so much work left to do. Showing you one example from Germany to start. So they have a project called 100 Green Productions where they tried to reduce the CO2 footprint of 100 productions and they actually succeeded. So for example, all the Germans know what a Tatort is. So every Sunday evening in Germany there's like one format which is called Tatort. It's a crime movie. So and this is like a very constant in the German media production. So this is always a good example. And they showed that for one of these productions, because there's so many of them, they could easily compare it. They showed for following the guidelines, they could reduce this year to emission by 42%. So and they also split it. So on the left side you have the traditional production capabilities and apologies that there's still some German leftover, but so it's offices, airplanes, trains, taxi, transport, energy, waste, catering and hotels. And on the right side, sorry on the left side you have the reduced, so the improved the following the guidelines on the right side you have the non optimized and you see also here flying and hotels are quite dominant. However bad news so we know stuff so we know we have knowledge on how to really reduce the CO2 footprint. However, in the Sustainable Production Alliance report from 2022, they also show or they ask in production environment about the degree or the percentage that they actually execute the guidelines for green productions. And what they show is so that only 8% of the people of the environments they ask implemented more than 80% of the guidelines. So what I say is like only 8% say they are implementing most of the guidelines that is like this expected value in the top and 44% of the people or the companies they

ask said they implement less than 40% of the guideline, like less of half of the guidelines. So there's really still a lot of work to do with like actually implementing the guidelines that we have. I showed you there are so many of them, but currently we really have to work on making them, bringing them into reality.

OK and moving now slowly towards our topic of post production. So apologies again for the German. So what you see here is sector shares from film production. So on top we have transportation and then we and the percentage of CO2 emission. And so we have materials, catering, offices, post production and production environment, the studio. And you see an average only 2% makes up for VFX and post production, what we are talking about. However, there's a huge range. So it goes from 2% to 26% of this year CO2 emission also shown here with like the these are the 100 greened production in Germany once again and the yellow. So it's the what you see is the total emission of CO2 and the different sector shares and the orange is the VFX and you see there's like on the left side there's quite an influential VFX and then it there are almost, there are couple of productions where you can't even see it. So it varies a lot. However, why these numbers are not so trustworthy is another thing I will explain to you during the course of this presentation.
So let's have a look a closer look at visual effects and actually what I wanted or I am already telling you, you should as of now with the given guide guidelines that we have. You need to consider this as post production because for example there are bunch of calculation tool and mechanisms and they only consider the creation of visual effects in the post production workflow or as post production. However, modern VFX technologies developments actually break that and we go from post production for example with real time engine or LED walls to create these visual effects they are moving into actually early in the production. So this is already a problem that in most almost all standards that I know of, they have a very rigid definition of what VFX is and where it is and they really put it like as it is traditionally into the end of the production as post production. And also once again what I mentioned here we really mean anything from like creating like these virtual worlds like here from the movie 2012 where like it's VFX all over but you also have to add up the small productions because in the end all almost all productions have some form of CGI so computer generated images. So for example this looks like a real image but the birds were added. So not like VFX or visual effects are not always visible. So what are the components of the relevant aspects or parameters to think about CO2 for visual effects or post production as we have to say. So of course you have hardware, so you have computers, you have displays, you have servers, you have LED walls that are kind of like the main components. Cloud computing might come also in, and so on. And for this hardware, you have to consider the usage hours. How many hours. You have to consider what type of energy? Is it energy coming from renewable sources, is this fossil energy and so on. And then you have to consider the external services. So in current VFX production, cloud storage and cloud computing for example for rendering, sending the computation of the final image is so complex that these days you often send it to what is called a render farm. So a render farm is you can imagine it like this cloud service which is somewhere virtual and you sent your rendering job there and they computed for you. So hardware usage, type of energy used in external services is what is currently mainly represented. And the question is here how to measure and one example or one current approach of doing so are the CO2 calculators, which all the different initiatives have. This is the German one, the CO2 calculator. And the idea is and it's actually quite relevant in Germany but also in other countries because thankfully I mean that's a good thing but for certain funding and in Germany film production is heavily funded or base is heavily based on funding getting public funding. You have to give them a CO2 budget of a production and you can use these calculators to do these this budget calculations.
So you would calculate the CO2 emission in kilogram and then if you show that you have, if you are below certain numbers you get the funding. And I mean it's a good idea, but as of now all the calculators I know are very limited and I will show you why. So for example the German calculator has categories, energy, travel, transportation, catering and materials. It looks like this. You can select a category and then you put in certain values. And here you have the value that you can give the source of the hardware source. So let's say CPU computer, GPU computer. So with graphics processing you say how many of

these computers are nodes. You say whether you have a smart use of the emitted heat. So heat waste usage is also a thing here. And yet you can give it the usage hour. So this is really an example of this tool which is very comparable to all the other tools. So you would for example go in and say hey I have a CPU rendering or I have a GPU rendering, so rendering on the graphics card. And then you can say something like, OK, I am having a grading place. So it's not giving you the hardware, it's just saying what you're doing with that, a grading place or you have an editing desktop or you have so a motion design desktop or computer seat. So it's very weirdly generalized and not very precise. But OK, let's say we are using that and let's say OK, we are VFX department and we have workstations that work 8 hours a day and we're using a server farm for rendering that is 20 hours a day. So now we have to really to we have to count what do we have. So let's say we have five budget computers that each budget computer has a monitor or display. We have 10 mid-range computers with two monitors or displays and you have 10 high-end-computers let's say like gaming computers also with two displays and you're using a server, a render farm server. So now that would be your start which you need to analyse and which you could put in the tool I just showed and then you would the tool would give you the numbers for that set up. So like I said we have a budget computer. So one budget computer emits half a kilogram if you use normal energy on non green and with green it's a fraction of that. So the usage of green energies does a lot for the mid-range computers with two displays you are a little bit higher, so 0.7 kilograms. Once again, dramatically reduced by the usage of green electricity which you can put into the calculator. High-end-computers are between 0.8 and 0.1 kilogram. We are kilogram now, not tons. We will move it into the tons at the end. And let's say we have a server farm, so meaning a lot of nodes that do the computation for us. So let's say we have a CPU and a farm with 100 nodes, air condition, it's between 300 kilograms and 20 kilograms with green energy, or when we use the emitted heat to create energy again, so we are between 230 and 16 and then with the GPU with a different hardware we are already dramatically higher. So we are between 890 kilograms and 63.50 kilograms. However, or let's say so in total coming back to tons. So in our best case scenario for our VFX department. So if we use green electricity, we use make smart use of the heat base, we use the CPU farm, we are at 21 kilogram a day so we would have one ton in 50 days which is quite a long time. If we use GPU, so different hardware, we are at 50 kilograms, 1 ton and 18 days. So give me a moment, this is very dry I know, but we are moving on in a second. So in the worst case scenario we are at 300 kilogram one. So now if we use air condition and the CPU from non green energy we are already at 1 ton in three days. So now we are dramatically like being worth and if you a GPU farm, so we are at one ton with this render farm in one day. So intuitively you might say with this calculator, hey let's not do GPU annoying, because that's so much worse. What's not considered here? And this is of course very complex. GPU rendering is much faster than CPU rendering. So a image that I compute with the CPU render might take let's say 3 days. I'm just these are fantasy numbers. But if I do the same render job with the GPU, this might just be one day. So you see how complex this is and how limited this is. And also what I want to mention here you have seen really like these big changes between using green electricity and non green, so like using renewable energy sources versus fossil energy sources. So what I hear a lot when I ask in the industry, it's like we're using in green energy so all is good and they are actually supported by these calculators to think so, because they are just referring to the usage of the hardware. But you might think already a second, what do we need between beyond the usage of the hardware? Well, the emission of the manufacturing and disposal processes and so there's very reliable data from a colleague of mine who does research exactly like this. So for big data center, it's true 80% of the CO2 emission is in the use phase. However, for like end consumer products like a computer, a notebook, a smartphone, a display actually 75 to up almost 100% of the CO2 emission when we look at the whole life cycle of these products come from the manufacturing process. So anytime so buying a new computer has for like a production for example for VFX production is much more influential or significant for the CO2 emission than the usage of the computer over like 100 days or so on. I mean these are of course also I don't have like a good comparison of these like VFX department numbers. I'm just telling you here what here really the take home message is you always have to consider the manufacturing and disposal processes of the hardware you are using. So if you're VFX and the calculators, by

the way, they are just looking at usage. So if a production buys 100 new computers for their production, this is like so much worse than a company that just uses the hardware. And of course that's also reasonable to do so because you save money with not buying new hardware. But it's relevant and it would be nice if these calculators or standards would be a little bit better in enforcing also these aspects like the reusage of hardware and of course with hardware it's not that just the CO2 like for computers a lot of like sources from the earth I'm missing the English here like production sources like sand or minerals or whatever that's needed. That's all in there too. So and to know a little bit more, so life cycle assessment is really relevant for like these consumer products or for these products we are using in VFX on post production. Actually how do you know these, how do you know what is the cost of the manufacturing? Well some month. So it's a manual, very tedious process to find this out. To figure this out some production, some hardware companies actually offer it to you and I'm by no way like want to advertise Dell products, but they do stand out a little bit because on their website (So I'm just giving you a year a screenshot of the Dell website) for every single of their products they give you a live cycle assessment. So for example, let me show it to you real quick, give me one second. So here for example you have the 27 inch monitor and they give you for the whole life cycle the CO2. So if I go here, they give you a sheet like this and they really consider like all the steps of they even go to towards packaging and so on. So they give you really nice information about a truthful assessment from start to finish of their products and this is really useful. But of course it's very like spread the date the information you as a user or you as a company have to collect this data and find it. But also it's still even if you have that data, it's very difficult because for example if you look at the storage system of death, they actually tell you well the CO2 footprint really on the life cycle assessment really depends on the configuration and what they give you in their sheet that I just showed you they say well the storage system can be between 4000, so four ton CO2 up until 226. So there is a huge range between how you use the hardware. So you see it's really, really difficult. But I really would like to encourage you if you are in the business of computing a sustainability value for production or CO2 footprint, this is relevant. So really also consider the manufacturing processes of the hardware we're using.

And now I want to give you an even more depressing, no, not depressing, but also tedious reality check of what we actually have to calculate if we really want to give you want to have a true CO2 footprint. In reality if we want to have true values and let's say from a VFX department. But this is actually applicable to any kind of IT. So let's say, OK, we have a couple of devices. We have, we have computers, we have displays, we have smartphones, we have a router and so on. So we have the devices. Then we have to consider the CO2 footprint of the communication networks we're using. So how are we sending data, for example, to our backup storage as well as through the Internet. So we have these telecommunication networks and then we have a data center. So like I said, this is representing for example rendering using a render farm for VFX. And now what you need to compute, and I'm going over it a little bit superficial, but so all the values you would need is the annual CO2 cost of the manufacturing of your device. So CO2 for the device manufacturing and you would need the energy used this usage. So when you use the actual device and you need to know the CO2 of the when the standby. So a lot of companies use standby, they don't turn off their devices. So we are now aiming towards let's say an annual emission value. So we need the manufacturing, we need the usage and we need the standby. Also by the way also green energy I was in a like one hour talk that just was about the CO2 emission from the energy used and that green energy is not equal green energy. So even if you say you have green energy, there's still of course CO2 emission from it. So and they're very complicated mixes. So you would also need to know to really identify OK, what is the CO2 emission from my electricity used. Then you have the telecommunication networks let's say sending data to the Internet to your data center. Here again very complex problem because you're not the only one. So I'm just showing you don't have to understand this diagram. Apologies if it looks scary, but telecom, it's like a communication network has so many different components and for example it's used by various companies at the same time. So how do you know what your data sending is, is using. So this in itself is like a really complex problem to compute the CO2 emission from your network usage. But here, so you would in theory need the CO2

emission from your data transfer and then coming to the data center to the render farm and the render farms these data centers actually thankfully are very well researched by now. So we have a lot of information about these data or render farms in regard to their server, storage, networking, cooling systems, energy consumption and actually which is a good thing, they're using this also as marketing, but here still they are open questions. So for example, we have no standards whether we define them by cost per service or for example cost per data amount. So are we charging or are we computing CO2 by the hour or are we computing CO2 by the TB? And they all do it differently, so almost no comparison possible there. But so let's say we have VFX department or company, we want to know our CO2 footprint. So what in reality if you really want to have a precise number. So in, in summary, what we need to do is so CO2 for the. So this is just a summary of what I just showed you. So CO2 for the device manufacturing. So this means the annual or the use in hours, the standby in hours multiplied by the emission from the energy used. Similar we need the emissions from the data transfer multiplied by the emission from the energy used. And we use need to have these values from our data centers or under farms use. And I know maybe this was really hard to follow because I have all these, it's a little bit more precise, so I simplified it in a little bit. So you also have all these WAT and these the units here, but so if you would compute this, you would have a fairly accurate billing or costs, CO2 costs per year. But as I've seen, so for example with the with the networks it's almost impossible. You would also once again go to averages and we don't even have good averages here. So what can you do as a VFX department? How can you measure your sustainability? So I showed you the CO2 calculators briefly. Once again, they are almost all or they are to my knowledge, they are all based on just the usage. They are not investigating life cycle. You can rely on information from manufacturing manufacturers. I showed you the example of Dell. They're doing quite a good job there. Or you can measure and calculate your data yourself. I gave you the formula for that. Good luck.

So it's all very lab laborious and difficult at the moment and it's really like it's we are at the beginning of getting this right. That's what I also really want to say here. So hopefully by throwing a little bit of complexity to you here is that you really understand where we are jet. And yeah, so maybe breaking it down a little bit more practical, what you can look out for is yeah, like I said, hardware specifications having maybe in your company or in your team, rules for acquisition, updating and disposal define maybe rules for your company, When is it OK to buy something new and when not and where does your stuff go? Make sure that you compute both usage hours and standby hours. But ideally maybe also try think about resource sharing, try to avoid idle times and with that buying more hardware. But maybe we using the hardware you have more smartly way to go. This is for small companies, not so achievable yet, but so for bigger companies with big render farms. Think about using the wasted heat so you can use the heat that is emitted from your hardware to use as energy again and big data centers are doing that. Look of course at the energy used. Of course I'm not saying that this is not relevant, but it's not enough. And like I said, I hear this all the time that companies tell me it's fine, we're using green energy. Using green energy is, of course, really good, but it's not the end of the solution or it's not just the solution. And if you use services, you as a consumer can of course put pressure on really asking for CO2 numbers and footprints from the services you're using.

And with that, I'm coming to an end. And yeah, let's maybe try to get here. I mean, this is, of course, purely fictional and generated from an AI. But, yeah, let's keep our planet green and let's not kill all the living, living things here. These are my contact details. And I hope you took something from my talk.
Thank you.

00:53:12 Marta Materska-Samek
It was very interesting. And *what is your motivation*? Because it's mainly IT based, and accounting energy used by the computers and the engines like GPU and CPU. *What was your main interest and how you was leaded into such topic, Lena?*

00:53:39 Lena Gieseke

OK, so first of all this this is not only my focus in my normal life, so I was recruited by Sophie and Björn for this topic. I'm a Computer science by training, so of course that's where my interest lie. But for example, I personally, and that's how I got there because I'm doing a lot of computer science. I'm doing a lot of VFX I used to be a VFX artist myself, so that's where that interest naturally came from. But to be honest, let me say that as of now, I think we need to focus a lot also on the contexts, like I said, we have so many standards. What do we need beyond these calculations? What do we need beyond the knowledge? How can we really influence people to change and to adapt and to use these standards that we have or to do this calculation? And this is also something I'm investigating, but of course also I'm not that qualified with being coming from computer science. I don't know that much about how to influence people or society, but that's to me equally of equal interest. Any other questions or thoughts or comments? I'm always curious also to hear what other people thoughts are. If you have some comment, that's also fine if you if someone wants to say something.

00:55:15 Marta Materska-Samek
Yes, you can ask freely. Oh yes, Vivian, please go.

00:55:21 Vivien Hoffmann
Yes, hi. *I wanted to ask if you maybe have like a recommendation for these render farms. Is there anything here in Germany that would be really recommendable to use?* Or how do you find out?

00:55:36 Lena Gieseke
That's a very good question. So lately I haven't checked. So the last time I checked this was for another talk I did, which was in September 23 and I have to say I was really underwhelmed by the information I could find. So basically there was almost none of this for the render farms, but I'm also equally interested in this topic, so feel free to drop me an e-mail and we can together find some information on this. But last time I checked for specifically the render farms, so VFX render farms they didn't. I couldn't find any information on that. But this is something we should all ask these providers, because we as consumers here should push them on giving that and at least using green energy, at least using the heat waste and so on. Very important and good question. Unfortunately I cannot answer.

00:56:46 Vivien Hoffmann
No problem. OK, and one more, at the beginning you said like the IT also it already starts with this 3D software with the coding. And if I'm for example like in a green consultant in a little production firm, what do I like recommend someone who is like doing the VFX thing in general, as I'm not totally into the VFX stuff, but in the production stuff, *how can I like recommend something that they can yeah, use for themselves even though I don't know something about programming or coding?*

00:57:26 Lena Gieseke
So again, unfortunately I have to disappoint you here with a nonspecific answer. This idea, sustainability by design within it, is currently starting in academia, so currently so this they're actually in Germany, they started just last year, a big research project where they investigate how you can reduce energy consumption by the code itself. It's not yet reached in the industry, so there are some examples outside of film production or creative media, audio, visual media production. But to my knowledge as of now in the in our industry, it's not part of the software yet. Let me think, no, so it's so this is really more like a research topic but a really nice, really relevant and this is for example what is called clean IT. So that's like why how I introduced it And for example our colleagues at Hasso Platner Institute in Potsdam, Babelsberg, they have a really a Research Institute where they try to get further with that. But as of now it's not reaching the software, the industry yet but it's a really relevant problem also with machine learning if I might add. So it's really fun, not funny but so for these machine learning algorithms that are based on machine learning. So for example the training of a of a machine learning algorithm is

hugely can be have a huge impact. So one can argue OK the learning. So the training of these algorithms is not done every time I use the software, not at all but it is done to get these AI based software. So whenever I train a machine learning algorithm it needs so much energy and so much with that it produces a lot of CO2. I forgot some concrete numbers but it's really it's really also an issue. So it's really good that we are starting to consider these things. As of now in machine learning we are more concerned with accuracy so that we have good results not yet so much that it's an efficient results but it's starting to get there. But I always I'm sorry I go far beyond what you asked but just finishing that thought I always so. I had a friend who is a computer science PhD student and he's very ecologically aware and he has no car and he didn't fly but his research topic was AI so he did a lot of algorithm training during the day which was when he so I mean he was aware but so it almost produced as if he would drive a car and fly and all the time. So this is really irrelevant these days for the development of new software. But yeah, once again, unfortunately I have to disappoint with I cannot give a concrete answer.

01:00:59 Vivien Hoffmann
OK. Thank you nevertheless.

01:01:03 Lena Gieseke
OK, anything else? If not, I mean feel free to reach out. I will definitely investigate render farms myself. It's good that you reminded me because I haven't done in in in a couple of months. Yeah, feel free to reach out if you if you want to know more, want to work together, I have ideas. And then Mata. I don't know if that should be closed or.

01:01:36 Marta Materska-Samek
Yes, we can. Thank you to be our guest. We are sorry that you had such bad fever I guess last time, but it was good example and can't remember it.

01:01:49 Lena Gieseke
Yeah, I just realized when talking about it.

01:01:53 Marta Materska-Samek
So and so thank you Lena. It was pleasure to host you during our meeting and we will we have your e-mail. So we will be in touch.