

## Position paper from Greening of Streaming for IAB Workshop.

### 1. Introduction

*Tune In. Turn On. Cut Back.*

*Finding the optimal streaming 'default' mode to increase energy efficiency, shift consumer expectations, and safeguard choice.*

Greening of Streaming is a group of technology vendors, service providers, and publishers who use technologies and services to form and deliver streaming audio and video content (and other high-capacity information) 'streams' using IP networks.

We work together to understand and improve energy efficiency in these processes. When operated at scale, these processes drive demand for huge amounts of energy from the underlying infrastructures that facilitate their operation.

While (for reasons that will be made clear below) we do not ourselves relate this energy demand to a carbon footprint or other evaluation, it is an intended consequence of our energy efficiency gains that we reduce environmental impacts. It is also an intended consequence that these efficiency gains reduce the cost of operations to the benefit of our businesses and our customers and end users.

As a recently formed group, We've begun measuring data but it is too early to publish a comprehensive report.

That said, in order to help motivate membership and participation, and to explain those motives to third parties, we adopt one broad set of measures. The IEA, Bristol University and others note that 'ICT as a whole uses around 3% of world energy.' Cisco and others note that 'Video comprises around 70-80% of network traffic'. Greening of Streaming therefore has a working estimate that streaming drives a demand for between 1 and 2% of world energy. This is comparable to the aviation industry. It is an incredible amount of energy for an industry that is less than 20 years old, and has only a few hundred operators.

Greening of Streaming is, through forum, debate, engineering, experimentation and education, working to increase awareness of this energy demand among the architects of streaming's supply chain, and to promote 'Power' as a KPI of equal importance to 'Price' and 'Performance'.

We foster a culture of being 'better energy citizens' among the engineers developing these services. We do not focus particularly on where the source of energy comes from (a reduction in our demand for renewables increases the availability of those renewables for other uses).

Whatever that source of energy supply, at Greening of Streaming we are working together to reduce our demand for energy, while constantly maintaining or improving the quality of service and affordability of services.

This position paper specifically introduces a key discussion that is being undertaken within our 'Working Group 6'. The topic is summarised as the 'Good Enough' discussion. While a 'green button' service model has been tried on interactive streaming systems (where an attempt to minimise energy through the workflow is selected, often at the trade-off of some degrees of quality), the fact is that the consumer rarely chooses to actively opt into a degradation (perceivable or not) in service. The 'Good Enough' concept turns that on its head and raises the idea that we may be able to collectively optimise around a 'default' or 'Minimum Viable Product' service level that ALL participants in the delivery and production workflow work towards with a goal of maximal energy efficiency throughout, while *still* allowing the consumer to opt in to a higher quality of service if they perceive they will get value from use of (for example) an 8k HDR 120fps stream. The fact that we may be able to 'default' TV viewing to a more energy-efficient default, while still offering consumer choice, is one of the unique possibilities that the Internet enables: We propose we explore using that opportunity.

## 2. Background

### 1. Scope

While our practical scope, by virtue of being 'streaming focussed,' is targeting 'what can be done within the IP / Internet domain,' other activities in Greening of Streaming have strongly highlighted that we need to engage every aspect - from policy makers, civil society, content producing cinematic arts, through the syndication and marketing processes into the distribution and consumer technology aspects. All these elements need to be taken into account and to work in concert to enable change.

### 2. Business Drivers

In simple terms, understanding what 'Good Enough' looks like will define a scaling (and related energy and carbon impacts) strategy for a baseline service. By collectively working toward energy efficiency around an acceptable 'default' service, we can harmonise many elements of the supply chain that are currently typically focussed on 'over provisioning for peak performance' - where that peak is arbitrary anyway. This can lead to tremendous amounts of energy being wasted across the ecosystem for the purposes of delivering peak performance on sparsely required occasions. Commercially, environmentally and in terms of efficiency, this 'status quo' needs to be reconsidered to benefit all stakeholders - not least the businesses that facilitate the services.

### 3. Application Drivers

Streaming itself is proving to be a tremendous support as more of the knowledge economy and other elements of our economies transition online. Ensuring that streaming can be delivered in an energy-efficient way not only means that we are replacing travel with a more energy efficient alternative such as video conferencing, but

also that we are working to make services such as video conferencing more economical to operate to increase adoption in less developed economies and so on. As energy prices fluctuate around the world, we are working to ensure that tools such as video conferencing are not only affordable but also 'clean' alternatives to enable a transition away from carbon-intensive commuting and travel to meetings.

### 3. Framework (Specific to the solution – what are you solving for)

To establish, through research, testing, and dialogue across the industry what “Good Enough” means in terms of QoE for the user and the underlying ‘MVP’ for the supply chain and its energy requirements and targets.

### 4. Considerations (Specific examples to consider in my mind)

1. To promote best practices that provide energy efficiency in encoding, packaging and delivery of video and audio to achieve a “Good Enough” quality. Furthermore, to help the industry invest in scaling to meet that target and optimise meeting it with minimal energy demands.
2. To recommend the use of technologies (e.g. compression schemes) that minimise the volume of data transmitted to reduce end-to-end energy consumption and delay the need for future internet infrastructure investment.
3. To ensure that the deployments of infrastructure are not unnecessarily ‘over-provisioned’ and yet remain capable of scaling up to meet demands.
4. To do so economically, in a way that promotes digital-inclusion (considering that potentially 50% of the world population is yet to ‘come online’)
5. To promote a ‘turn it off’ culture, so that systems can more readily be scaled back and are not purely provisioned to honour Service Level Agreements and performance promises which could reasonably be set lower, and through the supply chain can still be reasonably honoured without severe penalty or market distortion where energy considerations (and underlying environmental impact) compete with commercial and consumer expectations.
6. Ensuring a consideration of multi-tenanted shared infrastructure to reduce vacancy factor and ensure resource usage can be maximised avoiding duplication of energy consumption.
7. Energy supply considerations. Considering the energy supply chain to infrastructure and if it is obtained from sustainable sources.

### 5. Security Considerations

We don’t consider any of our strategies necessarily to affect security. In fact, by becoming less reliant on a large supply of energy, we aspire to make our component networks within the overall Internet, to become more autonomous and less dependent on fluctuations in energy market prices and wider geopolitical risk vulnerabilities.

6. Other Considerations (IANA, ICANN, etc)

Again we don't foresee that IANA, ICANN and other such organisations will be affected negatively. We plan to 'do the same' in terms of the Internet, only to 'do it more energy efficiently at scale'.

7. Acknowledgements

Greening of Streaming's working group 6 is focussed on this precise issue and is presenting this position paper to the IAB Workshop, and while that working group's role is to encourage consideration of these issues across the Internet community, and therefore it should be acknowledged as a precipitant to the discussion, we also invite industry technology vendors and service providers to proactively get involved in experiments to help to form a clear understanding of 'Good Enough' and so this workshop and its output will also become part of that acknowledgement.

8. References

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9. Informative References

10. Authors' Addresses / Organisational Submission details

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