

The environmental impact of Streaming – how do we measure?

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GoS drives real change through education and engineering

- Member-driven, not-for-profit
- Paid Executive, Volunteer Secretariat
- Industry voice for media & policy
- Best practices
- Data-driven: R.E.M, EPing, ...
- Community
- Holism
- Policy
- Core principle: **No Greenwashing!**

- Lexicon
- Outreach
- Policy & Best Practice
- Audio Streaming
- KPI and Capacity Planning
- The WattLab
- Academia and Liaison

7 Working
Groups



Ambitious hackathon
roadmap

Monthly all members
meeting

Regular workgroup
meetings



Greening of Streaming Members



ideas

HELP ME
RESEARCH
FOUNDATION
STREAM

Akamai

MAINSTREAMING®

Synamedia

broadpeak

AMD

V-NOVA

G & L

Agama

QUANTEEC

Humans
Not Robots

ZATTOO

TNO

arqiva

CTOi Consulting

Kibo121

eutelsat
EUTELSAT GROUP



Affiliate Members



DTG
THE CENTRE OF UK
DIGITAL TV

SVTA
Streaming Video Technology Alliance

EBU

arte

iabm

AIBD

Fraunhofer
FOKUS

CDN Alliance

Some observations on networking, energy and capacity

- The traditional way to resolve almost any issue in IP networks, is to throw resources at the problem until it goes away.
- SLAs (over)rule!
- Each 9 costs an order of magnitude more than the previous one.
- The Telecom bubble that burst 25 years ago left a lot of dark fibre.
- Empty 5G vs full 4G exemplifies several dilemmas (deferred infra).
- Peak capacity has a straightforward relation with energy use.
- The relationship between data and real-time energy use isn't clear.
- Reduction in capacity planning translates to linear energy reductions.
- Mobile networks, use (10 to 20x) more energy than fixed line, but are also more optimised to cope with variable load.

Sustainability of a Smartphone vs a Network Router

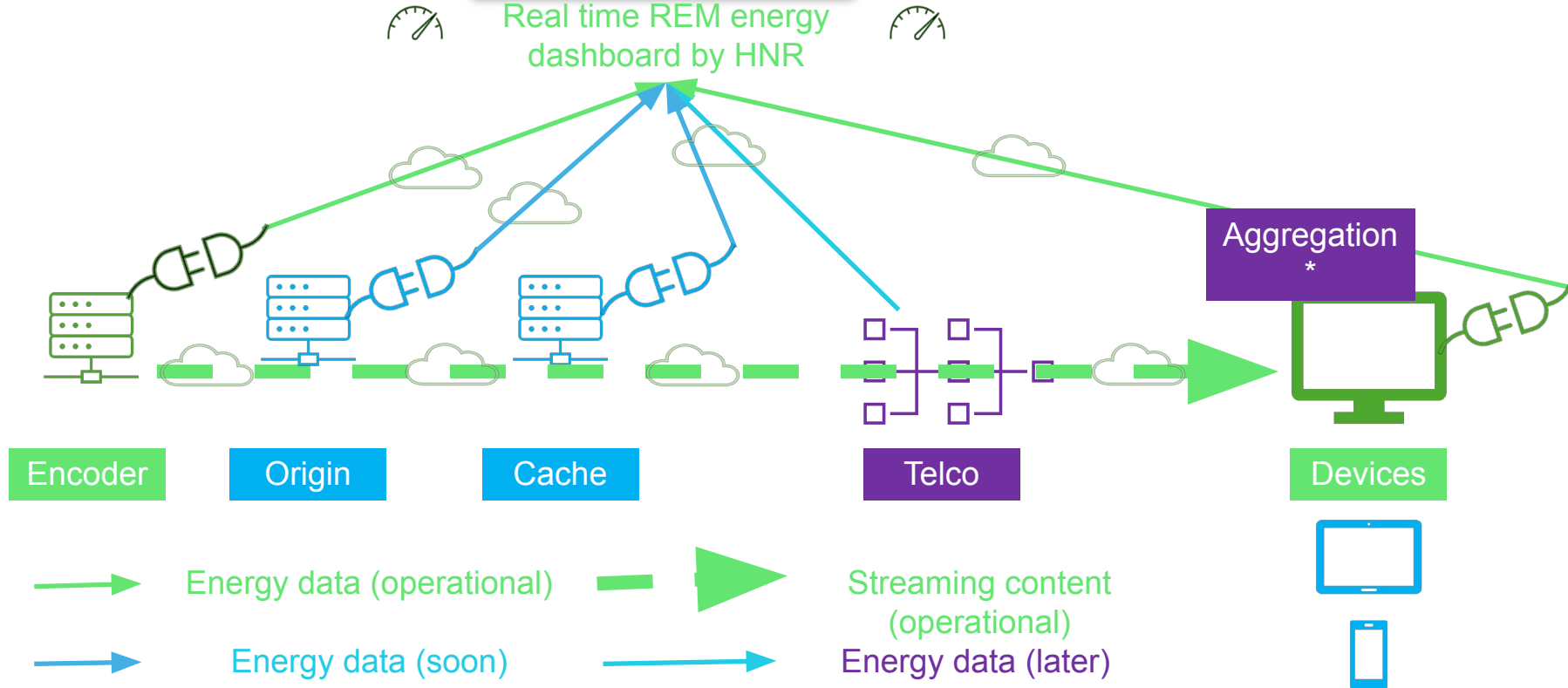
TO DO
Sourcing!!
!

	Smartphone	Typical Network Router
Shelf-life	2-4+ years	5-10+ years
Manufacturing Impact	Complex, energy intensive	Simpler
Repair/Upgrade-ability	Very Bad	Medium to Good
Typical Usage Power	Low: 2-5 kWh/y	High: x 1000 for 24/7
Customers served	1	Many thousands
EoL recycling	Typically 20% parts reused	Refurbishable, better recycling
Total CO2e Footprint	50 kg CO2e	1-5 t CO2e
Build/Usage/EoF	80% - 15% - 5%	35% - 55% - 10%

How GoS is Collecting Energy Data



Real time REM energy dashboard by HNR



Encoder

Origin

Cache

Telco

Devices

Energy data (operational)

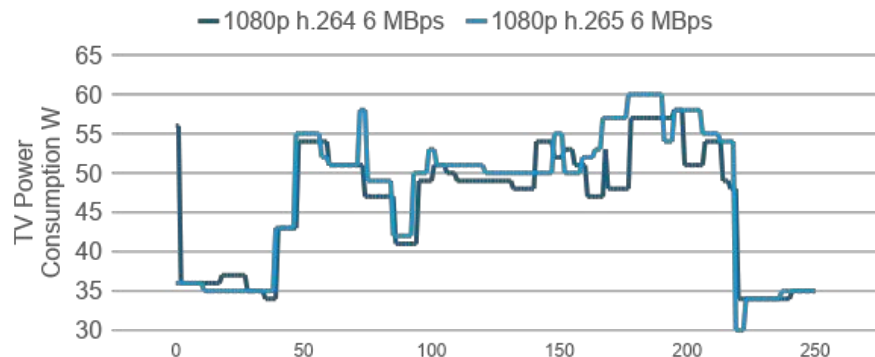
Streaming content
(operational)
Energy data (later)

Comparison of power consumption with codec change

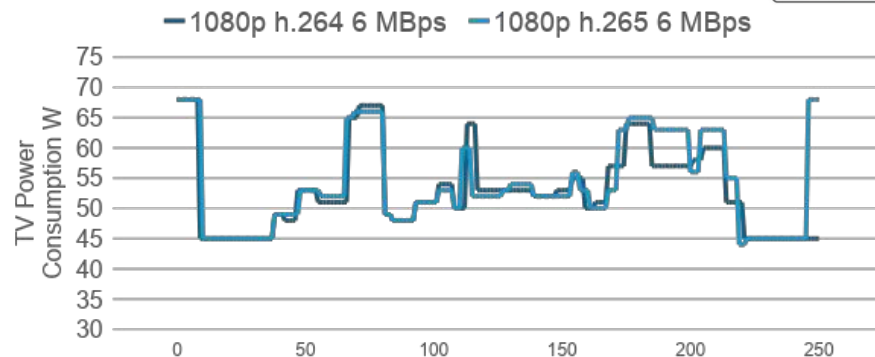


LESS

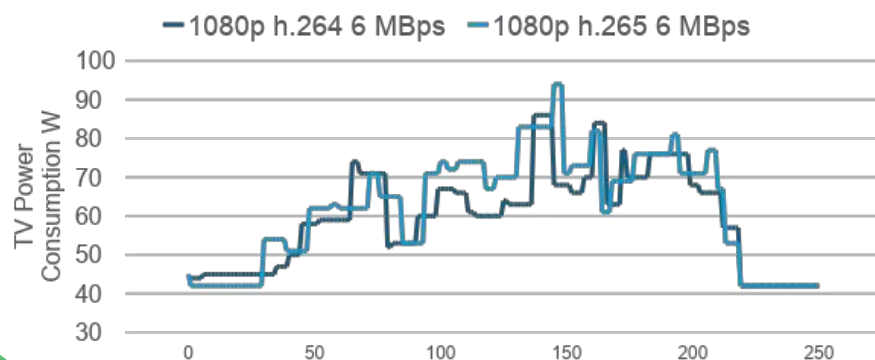
QLED 55"



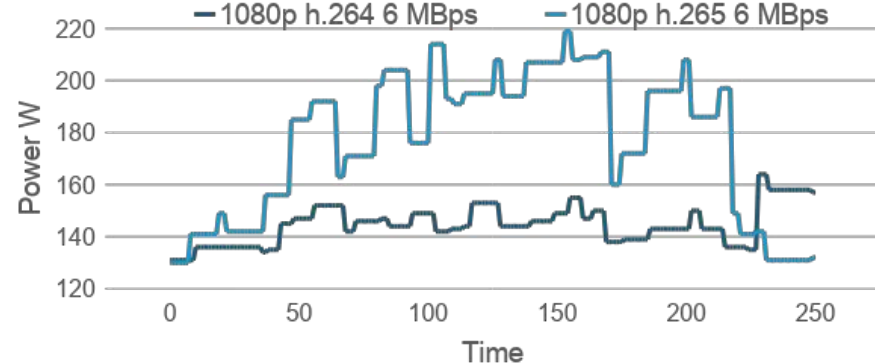
LED 55"



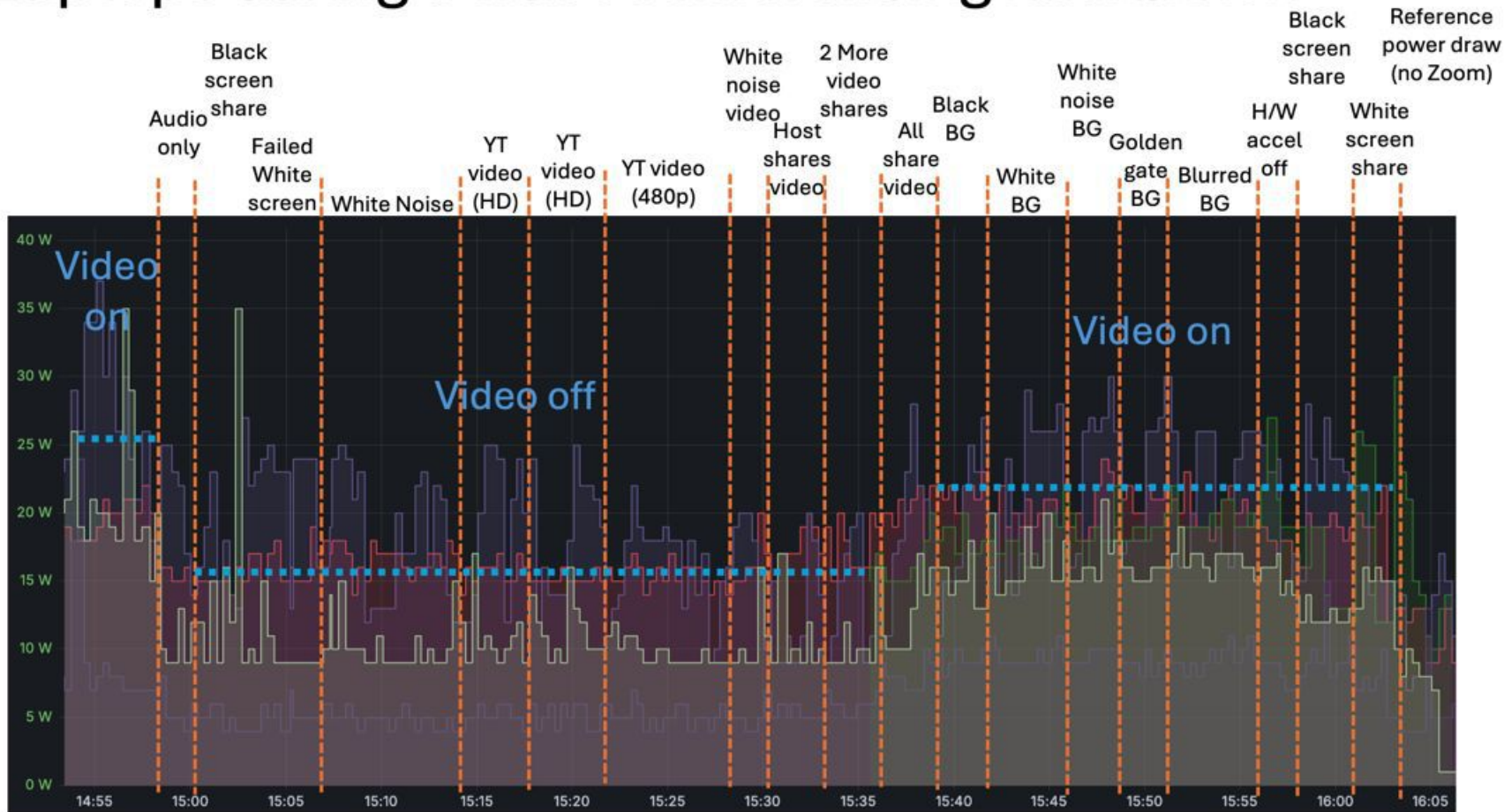
OLED 43"



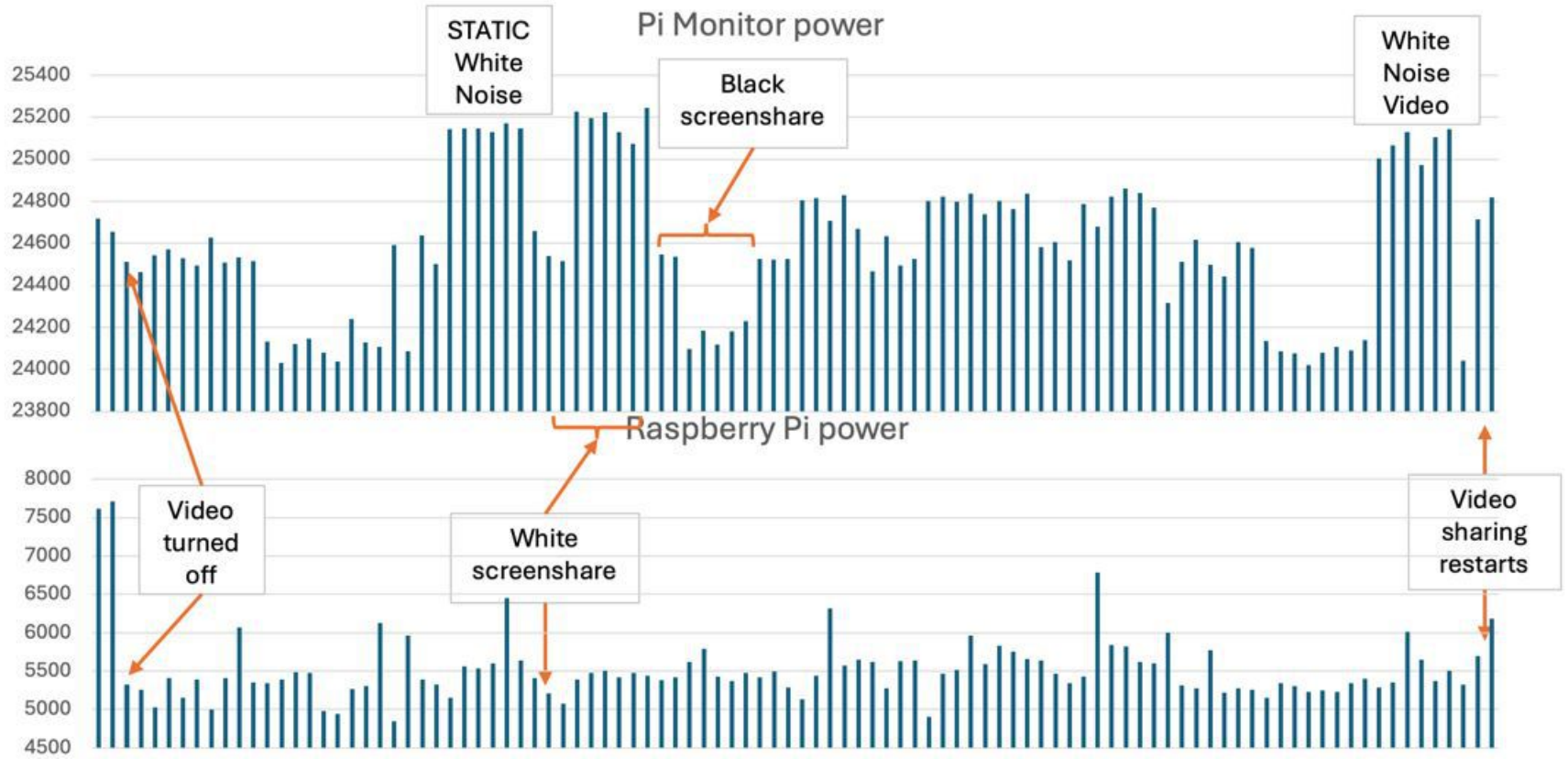
Encoder Power Consumption



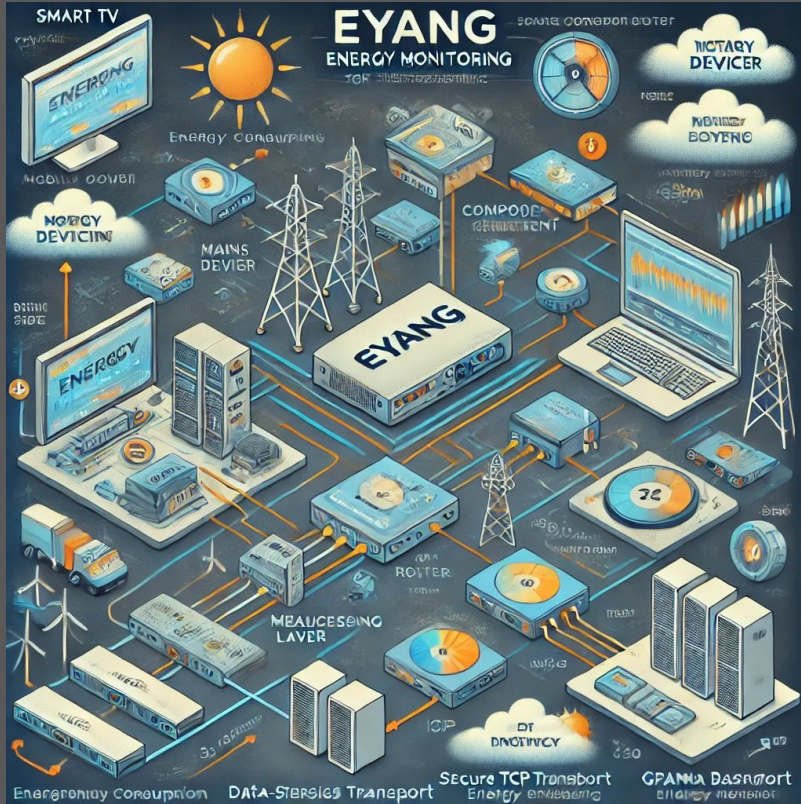
Laptops during a videoconferencing hackathon



Milliwatt measurements needed for PC screens



EYANG: Real-Time Network Energy Streaming Monitoring



- Network protocol to obtain energy data from any networked device
- Standardised YANG model for real-time energy measurement
- Supports component-level (B-side) power monitoring
- Seamless integration with existing monitoring & streaming infrastructures
- Provides accurate, empirical data to replace energy estimations
- Enables energy-efficient optimizations and regulatory compliance

Very preliminary Recommendations for Energy Reduction

Users	Content providers	Internet Service Providers	Content Delivery Networks	Hardware Manufacturers	Standards Development Organisations	Regulators	(IABM, CTA, UHDA, SVTA, DTG, Shift...)
Lower ambient lighting, to lower screen brightness*	Avoid autoplay by default (have timeout) Gamify green- - Dark backgrounds (UI)	Integrate energy metrics into protocols*		Longer-lasting black plastic for CPE... Recycled, longer lasting materials	Energy Metrics in protocols (EYANG → IETF)	All stakeholders publish energy consumption	“Data = Energy” ⇒ Greenwashing
Keep devices in use for longer, most cases (educate on good tech)	Delay features needing new hardware - Retain Backward compatibility - -			New HW only if E efficiency > 10x Operating / Embedded	The breadcrumb project	“Average shelf-life” metric for CPE	
Holism, Business, With Life							
Turn screen off for audio only (Needs UI support) ⇒ HW	Gold button, not green button			Sustainability from the design phase		Brightness metric for video	
Avoid peak hours where possible	Brightness reduction tech			Brightness reduction tech		IPR regs create unnecessary storage	

Orange/red: ideation (could be wrong), Green: WiP (expect to be correct) , Gold: Validated

GoS achievements and why you should participate

Sustainability Focus: Keeping it central in industry discussions

LESS Accord Projects: Launched in 2023, presented at 27 global events

Correct Misconceptions: Clarify energy-data relationship & CO2 impact

Reducing Waste: Optimized workloads to use surplus renewable energy

Inspire Research: Positioned energy as a key KPI in design

Collaborative Learning: Supported organizations exploring sustainability

**Reduce streaming's
impact collaboratively**

**Get actionable data and
real-world solutions**

**Participate in ongoing
research**

**Implement and share
best practices**

Engage policy makers

**Avoid (unintentional)
greenwashing!**