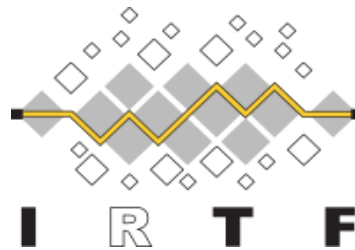


*Proposal for a new RG*

# SUSTAIN

## Sustainability and the Internet



Ali Rezaki, Eve Schooler, Michael Welzl

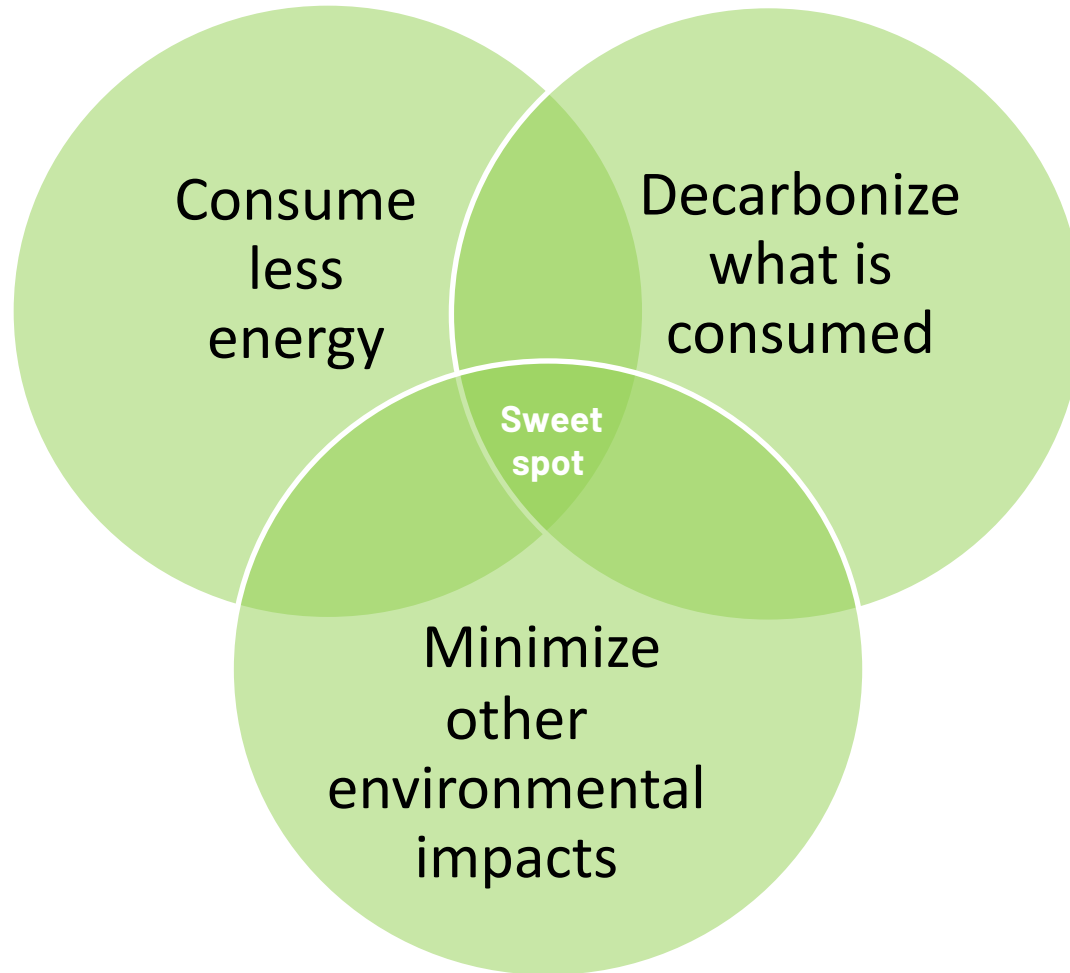
HotRFC @ IETF 121 – Dublin

Sunday, Nov 3<sup>rd</sup>, 2024

# Backdrop

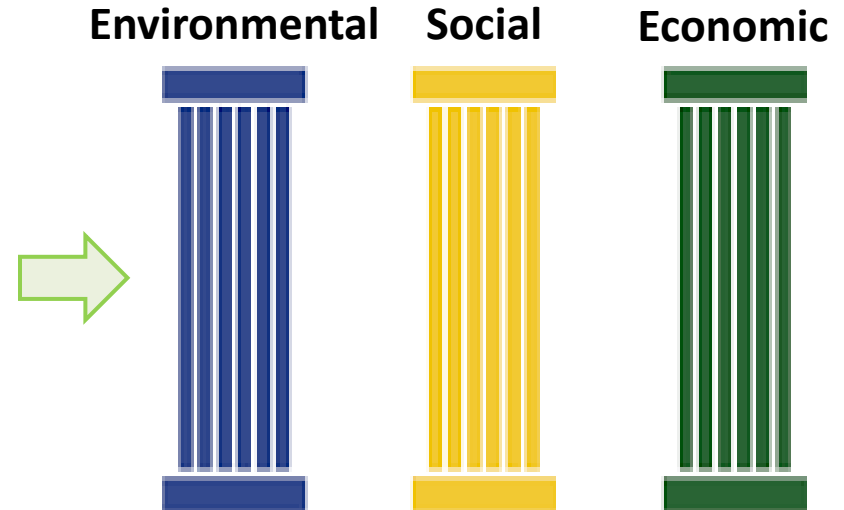
- Urgency to address UN IPCC recommendations
  - 1.5C degree threshold - minimize climate change impact
- Timeline to reduce GHG emissions
  - 50 % by 2030
  - 100 % by 2050
- ICT contribution to GHG emissions sizeable and growing
  - Network impact rivals Data Center
- Exacerbated by growth of AI

# Traditional Sustainability Goals?



# Broader Sustainability Pillars

“Meet the needs of the present without compromising the ability of future generations to meet their own needs.”



# Vision

Contribute to the advancement of the Internet as a fundamental part of a sustainable and resilient society and planet, through conceptual and evidence-based research collaboration

# Scope: From a **Networking Design Perspective...**

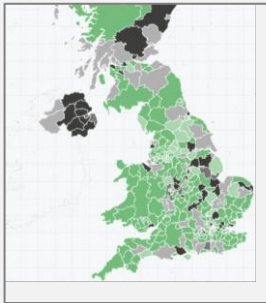
- Explore research challenges developing and operating a sustainable Internet
  - examine **longer-term research**
  - and its **trustworthy dissemination**
- Investigate **architectural and policy implications**
  - without going into advocacy actions
- Consider **footprint & handprint**, *i.e.*,
  - Sustainability of the Internet
  - Internet for Sustainability

# Beyond the Technical

## Country-Scale Electricity Usage

- Internet networking is on par with many developed nations

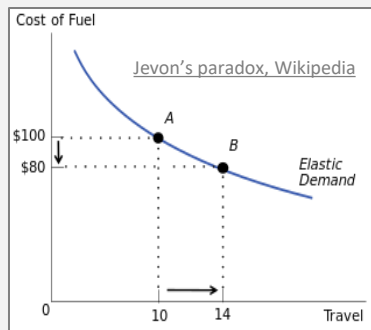
<https://carboncopy.eco/local-climate-action>



**Who/How to effectively, responsibly manage?**

## Tackling Jevon's Paradox

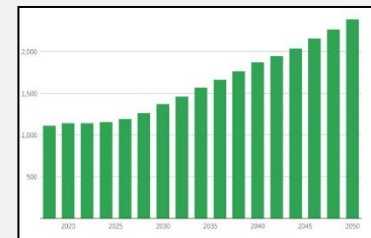
- Increased efficiency →  
Reduced cost →  
Greater usage



**How to make efficiency gains stick?**

## Huge eGrid Growth & Transition

- 2x-4x electricity needed to electrify transportation
- Edge-ification and Renewables
- ICT as a virtual battery



**Disruption = Opportunity!**

# More Internet Sustainability Concerns

## Financial Incentive: Tax Credits

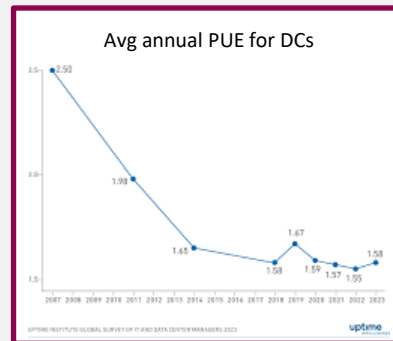
- A huge lever to incent the (US) infrastructure to transition to renewables



**Accelerate the uptake of  
renewable energy!**

## Policy: DC Standards

- Server power efficiency timelines
- Unintended consequences



**Voluntary → Mandated**

## Ethics

- ***“If country X wants to be a world leader in AI”***
  - **Q:** should they support AI’s unbounded use of electricity?
- ***“If AI holds the promise to accelerate innovation”***
  - **Q:** should AI receive special compensation re emissions goals?



# Solicit Research Contributions



## Investigation

- **Footprint reductions** of Internet networking (environmental, social, financial), with awareness of lifecycles and supply chains
- Environmental **limits & boundaries**, e.g., for safety
- Relationship between **sustainability and architecture**, differing approaches to network design, tradeoffs
- Novel steps toward energy efficiency, energy savings and **energy proportionality**; progress towards overall GHG emissions reductions, like **carbon-aware** routing, carbon-aware traffic steering and carbon-aware data transmission
- The **interplay between energy-networking infrastructures**, e.g., role of renewables to power Internet and on-demand Internet to consume excess renewables

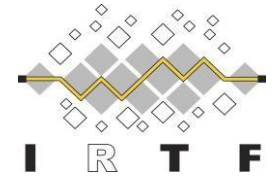
## Understanding

- Role of **policy and regulation**
- Potential for **rebound effects**
- **Incentivization** of sustainability
- New methodologies, architectures and strategies to ensure Internet **resilience**

# Mode of Operation

- Invite participation from industry, academia, govt
  - Meet regularly, encouraging hybrid participation
- Coordinate with others
  - RGs (ICN, DIN, GAIA, HRPC)
  - WGs (GREEN, TVR, OPSWG)
  - E-impact, ISOC, other SDOs, consortia
- Produce Informational RFCs on SoTA, gaps, etc
  - Defer standardization to the IETF

# Come to the Side Meeting!

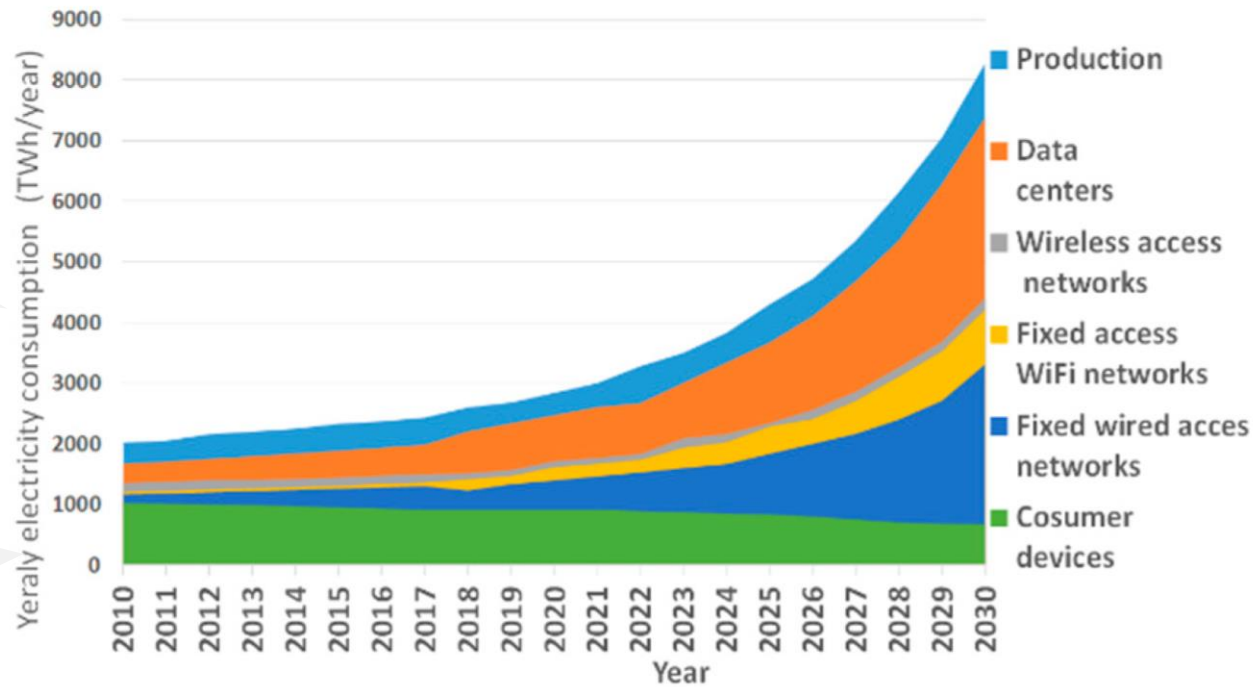


- **What:** Discuss proposed SUSTAIN RG charter
- **When:** Weds, Nov 6<sup>th</sup>, 2024 @ 14:30 (UTC+0)
- **Where:** Wicklow Hall 2A
  
- **Who:**  
Ali Rezaki <[ali.rezaki@nokia.com](mailto:ali.rezaki@nokia.com)>  
Eve Schooler <[eve.schooler@gmail.com](mailto:eve.schooler@gmail.com)>  
Michael Welzl [michawe@ifi.uio.no](mailto:michawe@ifi.uio.no)
  
- **GitHub repository:**  
[https://github.com/rezaki-ali/IRTF\\_SUSTAIN\\_RG](https://github.com/rezaki-ali/IRTF_SUSTAIN_RG)

# BACKUP

# ICT Electricity Usage...Growing Significantly

*Q: Measured vs Projected?*



US consumes  
~4000 TWh/yr

UK consumes  
~325 TWh/yr

**Information  
Communication  
Technology  
(ICT)**

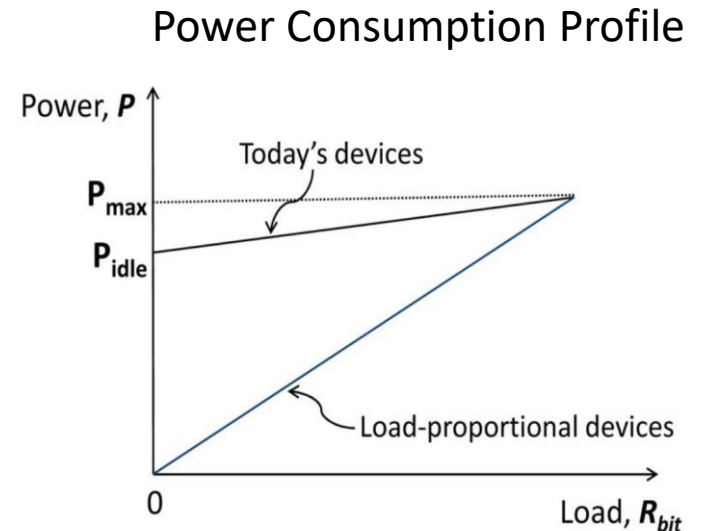
projected energy  
usage as a  
percentage of  
total electricity  
**is notable!**

*(2%-24% forecasts)*

Source: Lorincz, Josip, Antonio Capone, and Jinsong Wu. "Greener, energy-efficient and sustainable networks: state-of-the-art and new trends" Sensors, (2019): 4864.

# Sustainable Network Challenges

- **Many Networks are NOT *power-proportional***
  - Same energy expended irrespective of traffic load
- **Network *idle power* is significant**
  - Often very close to max power
- **Networks are vastly *overprovisioned***
  - Few network elements support *sleep states*
- **Networks are not *carbon-aware***



Source: "Modeling Energy Consumption in High-Capacity Routers and Switches", A. Vishwanath et al, IEEE JSAC, Vol.32, No.8, Aug 2014