

OPSAWG@IETF117, San Francisco, California  
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# Green Networking Metrics

## draft-cx-opsawg-green-metrics-00

<https://datatracker.ietf.org/doc/html/draft-cx-opsawg-green-metrics-00>

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# Overview

- Green Networking Metrics
  - <https://datatracker.ietf.org/doc/html/draft-cx-opsawg-green-metrics-00>
  - Alexander Clemm, Lijun Dong, Greg Mirsky, Laurent Ciavaglia, Jeff Tantsura, Marie-Paule Odini, Eve Schooler, Ali Rezaki
- Supersedes draft-cx-green-metrics-02 (targeting opsawg, now reflected in name)
- Purpose
  - Visibility and instrumentation recognized as important building block for sustainable networking solutions
  - This starts with defining a useful set of metrics

# Updates from -02

- Eve Schooler and Ali Rezaki joined as co-authors
- New section on green metrics defined elsewhere (notably ETSI)
  - Specific analysis of existing inventory is TBD
  - May adopt metrics from other sources and cross-reference as applicable
- New section on controversies (e-impact mailing list)
  - Metrics distortion and gaming, benchmarking, good vs bad vs useful – kwh/gB
- Editorial updates and refined discussion throughout
  - Updated terminology, updated references
  - Clearer distinction between primary and derived metrics
  - Usage examples for metrics
- Draft has grown from 19 to 24 pages

# Recap

## Equipment/ Device

Attribute carbon footprint to the “root”

Energy consumption, energy utilization efficiency

Considerations for energy sources

- Sustainability factors, modifiers (e.g. adjust for energy mix)

- Conversion factors between “power” and “carbon”

Virtualization considerations: virtual energy, virtual footprint

- Attributing carbon footprint incurred by hosting infrastructure to VNFs, etc

Examples

- Power consumption absolute / normalized, per chassis/line card/port, etc

- Consumption ratings (datasheet stuff)

- sustainability ratings and factors

# Recap (contd.)

Flows	Relate carbon footprint to flows and service instances Function of volume and duration Additional considerations for packet replication, loss, etc. Carbon flow statistics, enable carbon-based accounting Examples: Energy consumption / carbon footprint over duration of flow
Paths	Assess carbon intensity of paths and route alternatives Energy-/ Carbon-/ Pollution-Aware Networking Examples: Path energy/carbon ratings (function of carbon ratings of hops)
Network-at-large	Totality of the picture aggregated across network-at-large Examples: Total energy consumption (MWh), Network energy efficiency (MWh/PB)

# Recap (contd.)

- Holistic Perspective: energy consumption versus other factors
  - Energy consumed  $\neq$  carbon footprint
    - Account for energy sources (windmill vs Diesel generator)  
Specific sources not always known but may assign factors based on energy mix
    - Apply conversion formulas power vs carbon
  - Accounting for “other stuff”: HVAC, for hidden devices
    - Can apply additional sustainability factors as a “tax”
  - Sustainability of equipment itself: accounting for inherent carbon within the device
    - More factors: account for energy for production, amortized over device lifecycle, adjusted for recyclability, etc.
  - Maintain base energy consumption metrics and adjustment factors separately
    - Apply factors as secondary metrics (e.g. MWh/PB  $\rightarrow$  Carbon kg / PB  $\rightarrow$  deployment weighed carbon kg / PB)
- Certification
  - Trustability of energy / carbon ratings (specifically but not only for equipment metrics)
- Dealing with imprecision and uncertainty
  - Specify ranges vs absolute values in some cases (e.g. power consumption of links)

# Next steps

- Refine analysis of metrics defined elsewhere e.g. ETSI
  - with view on which ones to cross-reference & review
- Some more editorial updates
  - E.g. re: normalized metrics – Kiran Makhijani comment on list
- Ask OPSAWG working group adoption

**THANK YOU!**

Comments? Questions? Please contact us  
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