GREEN@IETF121, Dublin, Ireland
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# Green Networking Metrics

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

https://datatracker.ietf.org/doc/draft-cx-green-green-metrics/

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# Overview

- Green Networking Metrics
  - https://datatracker.ietf.org/doc/draft-cx-green-green-metrics/
  - Alexander Clemm, Carlos Pignataro, Eve Schooler, Laurent Ciavaglia, Ali Rezaki, Greg Mirsky, Jeff Tantsura
- Replaces draft-cx-opsawg-green-metrics
  - GREEN WG appears to be a natural landing spot for this work
  - Presented & gathered interest in eimpact but did not gain traction in opsawg (opsawg does not focus on environmental sustainability)
- Active Internet-Draft since July 2022
  - Including content changes from broad input, and file renaming.
- Purpose
  - Visibility and instrumentation recognized as important building block for sustainable networking solutions
  - This starts with defining a useful set of metrics and explaining their potential use
- Relationship to other drafts
  - Since this work started, some YANG data models have started to appear in other drafts
  - This draft does not define YANG data models but a set of metrics they can draw from

# Green Metrics

| | |
|---|---|
| Related to Equipment/ Device | Attribute carbon footprint to the “root”<br>• Energy consumption metrics – raw/ absolute and normalized/ attributional (at device, module, port levels)<br>• Green metrics beyond energy consumption (e.g. sustainability factors to account for power mix)<br>• Virtualization considerations: virtual energy, virtual footprint (attribution of energy incurred by physical infrastructure to VNFs etc) |

# Green metrics (contd.)

| | |
|---|---|
| Flows | Attribute carbon and energy usage to flows and service instances<br>• Function of volume and duration<br>• Additional considerations for packet replication, loss, etc.<br>• Carbon flow statistics to enable carbon-based accounting |
| Paths | Assess carbon and energy intensity of paths and route alternatives<br>• Facilitate Energy-/ Carbon-/ Pollution-Aware Networking<br>• Examples: Path energy/carbon ratings (function of carbon ratings of hops) (Compare e.g. also draft-petra-green-api) |
| Network-at-large | Totality of the picture aggregated across network-at-large<br>• Assess and optimize carbon outcomes as a whole<br>• Examples: Total energy consumption (MWh), Network energy efficiency (MWh/PB) |

# Other aspects addressed in the draft

- User perspective
- Holistic Perspective
  - Energy consumed ≠ carbon footprint
    - Account for energy sources (windmill vs Diesel generator)
    - Apply conversion formulas power vs carbon
  - Accounting for “other stuff”: HVAC, for hidden devices
- Sustainability of equipment itself: accounting for embodied carbon
    - Account for energy for production, amortized over device lifecycle, adjusted for recyclability, etc.
- 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)
- Green metrics defined elsewhere (notably ETSI)
- Controversies
  - Metrics distortion and gaming of metrics, benchmarking, good vs bad vs useful metrics

# Next steps

- Ask for working group adoption
  - The I-D has been incorporating feedback and input since July 2022
  - It appears (to us) relatively comprehensive and quite mature
  - It provides a meaningful reference point for other work that can build on top within GREEN
- Questions? Comments? Please contact us: draft-cx-green-green-metrics@ietf.org

**THANK YOU!**