Input from Operators to GREEN BoF

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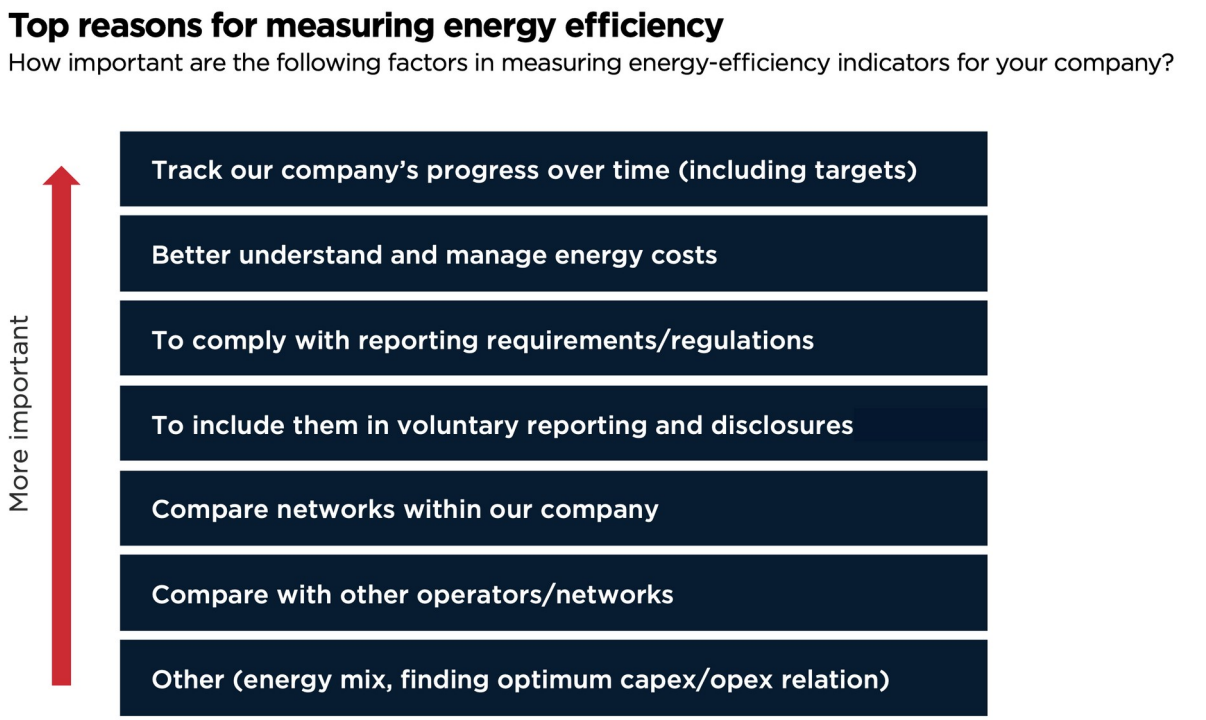
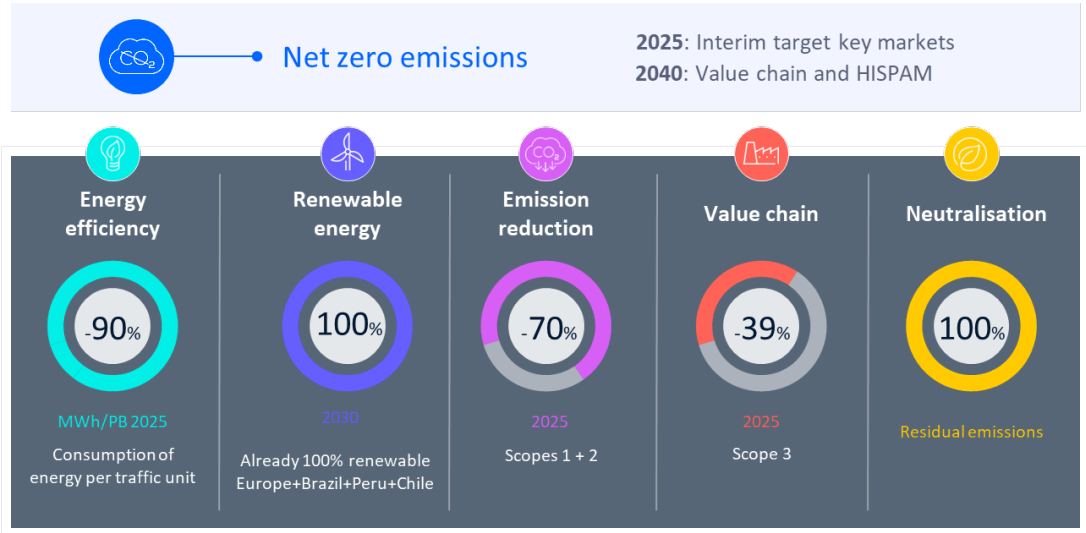
Context

- Industrial concern
  - Different actions on climate change in operators' organizations (GSMA, NGMN, etc)
  - data network energy use was 260-360 TWh in 2022 (Source: IEA, https://www.iea.org/energy-system/buildings/data-centres-and-data-transmission-networks)
- Company social responsibility
  - E.g., Telefonica: https://www.telefonica.com/en/sustainability-innovation/environment/energy-and-climate-change/



Source: GSMA, https://data.gsmaintelligence.com/api-web/v2/research-file-download?id=79791&file=270224-Measuring-energy-efficiency-of-mobile-networks.pdf



Source: Telefonica, https://www.telefonica.com/en/sustainability-innovation/environment/energy-a

Considerations

- In operation
  - Cycle “Observability → Analysis → Control/Management”
- Before operation
  - How much carbon is before operation
- Accuracy

In operation

Observability

- Component granularity, i.e., the **more granular information** one can obtain (per line-card, per-port), the better
- **Improvement** of **metering solutions** (finer granularity, control of the energy efficiency and saving, interoperability, exposure)
- Availability of **information** on the power consumption of the device, **without** needing **instrumentation** connected to the infra
- **Triggering of alarms** when consumption deviate from a nominal usage

In operation

Analysis

- **Common definition of energy efficiency** in network devices/components
- **Common methodology** of measurements for fair comparison
- How to provide **accurate figures** (context of the measurement in terms of time period, location, traffic, etc)
- Definition / concept of **efficiency**
- **Database** for decision in case of large data transfer
- Ability of **multi-layer analysis** (e.g., IP plus optical)

In operation
Control/Management

- To have devices with **elastic power consumption** according to the carried traffic
- Support of **network-wide energy saving and optimization** functions
- Support of **network-wide control of energy** optimization APIs allowing external applications to optimize consumption
- **Advanced sleep mode**, needing some sort of low power mode when node is lightly utilized
- Ability to **steer traffic based on power** savings
- Comparison of **decision vs optimal** case
- **Synchronous query support**

Before operation / In operation

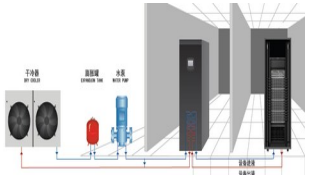
Other aspects

- **Inventory** of power components (of devices, racks, etc) including together their capabilities, optimization control capabilities and nominal condition use
- Optimize the overall **CO2 footprint** (i.e., energy mix based on source type) facilitating the engineering of PoP migration
- Support both **GHG/energy units**
- Clean energy, gas emission and **sustainability in general**
- Interaction with **other domains**
  - Inclusion of data center networks in the picture
  - Power reduction in cell sites can produce the highest savings
- **Accounting of legacy** installed base GHG/energy
- Track device/network **Before/In operation consumption**
- **Planning and architecture** of the network

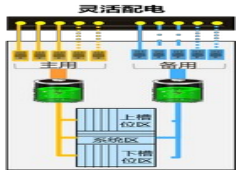
Analysis of router energy saving and emission reduction technologies (exercise from China Mobile)

Deploy and implement energy-saving technologies from the network level, device level, board level, and chip level.

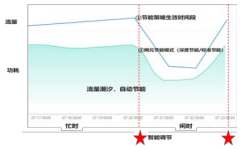
Network level



Liquid cooling



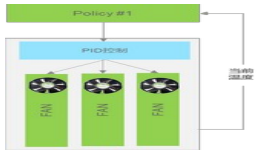
Energy consumption data collection



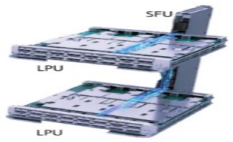
Tidal energy saving

Intelligent management and control

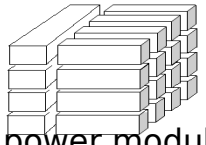
Device level



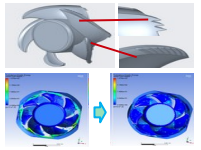
Intelligent fan speed regulation



Orthogonal architecture

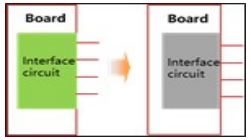


The power module is Dynamically adjusted

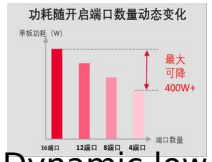


Mixed-flow fans

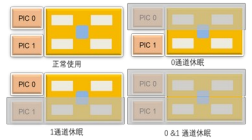
Board level



Low power consumption Model for Board、Card and Port etc.

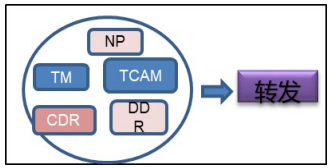


Dynamic low power consumption

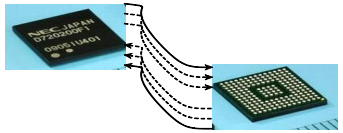


Slice dormancy

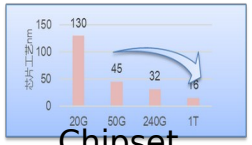
Chip level



Chipset function integration



Dynamically shut down the SERDES link



Chipset process optimization