ETSI Summit on Sustainability

3GPP approach to Energy Efficiency

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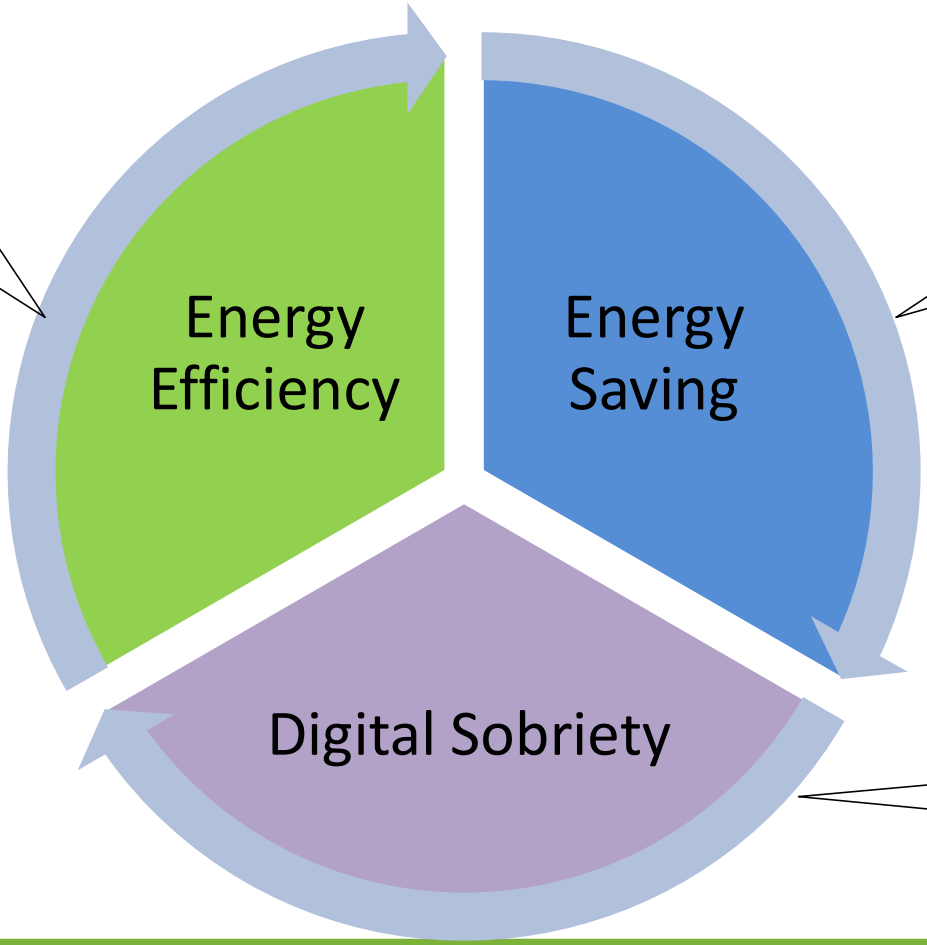
Sustainability in 3GPP - Three aspects

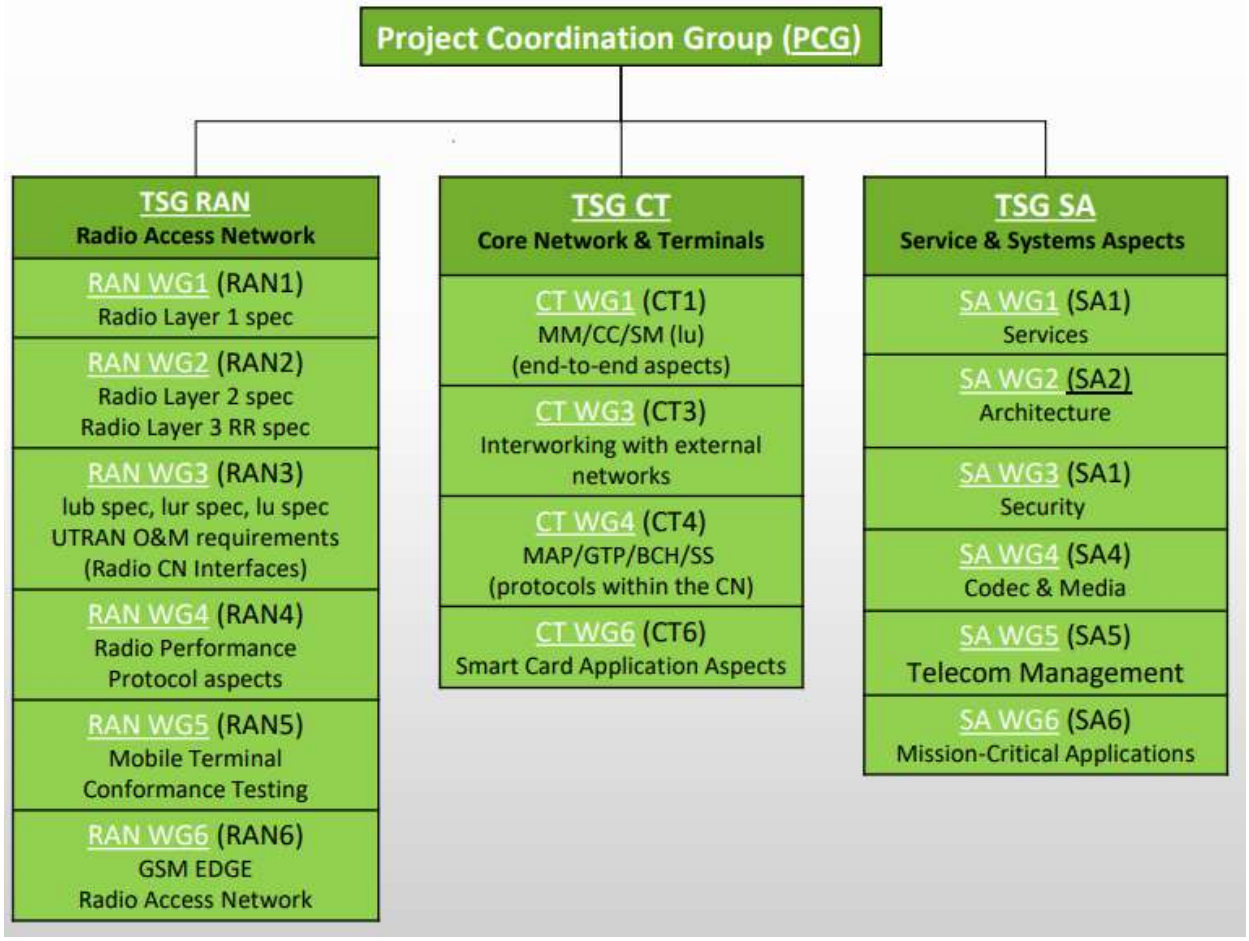


- KPIs and measurements
- Measurement method

- Use cases and solutions to optimize the Energy Efficiency

- Eco-friendly usage
- Eco-design

3GPP organization



Energy Efficiency

Energy Saving

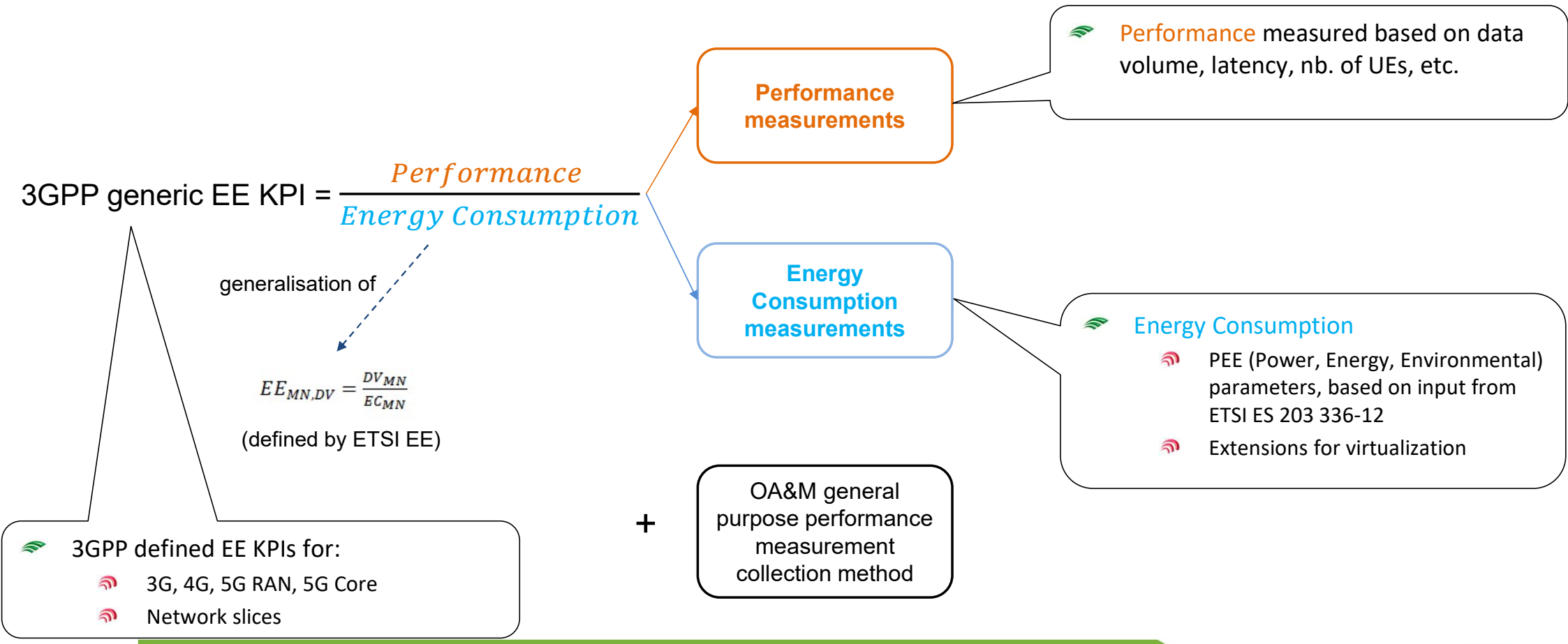
Digital Sobriety

Energy Efficiency

1. EE KPI definitions
2. From Rel-17, the focus extended to RAN + CN + network slicing
3. Based on measurements collected on RAN or CN network elements / network functions via OA&M
4. Principles:
    1. Rel on ETSI TC EE specifications as much as possible
    2. Extend only if and where needed

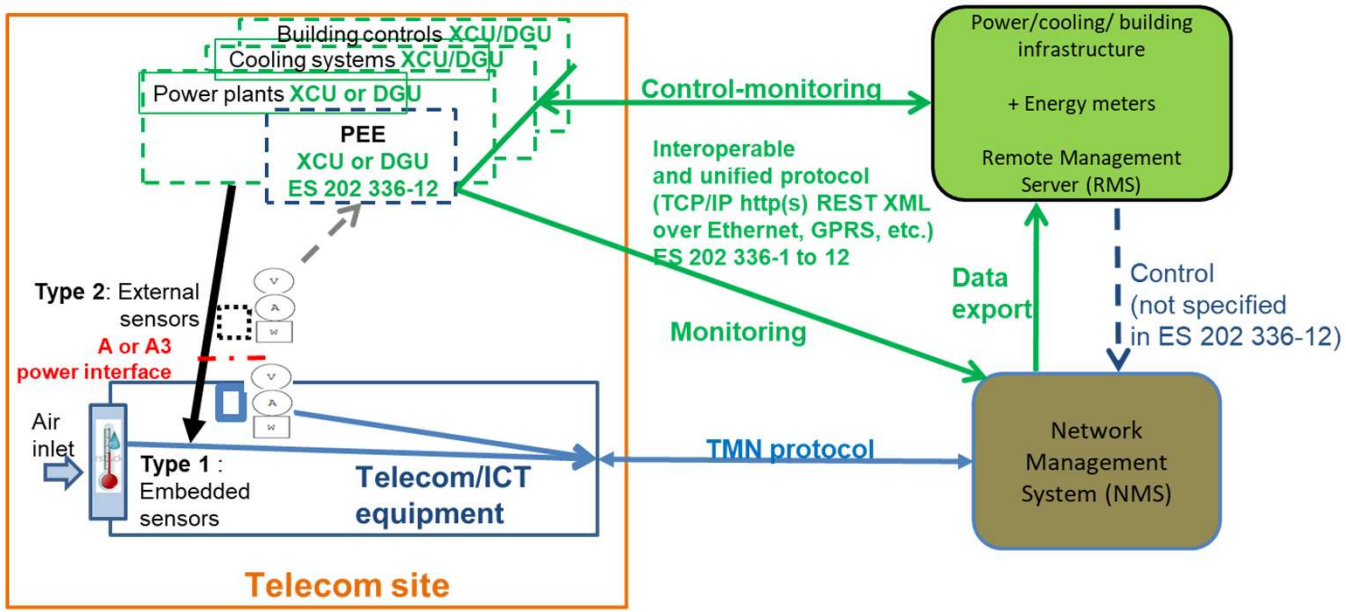
KPI: Key Performance Indicator
RAN: Radio Access Network
CN: Core Network
OA&M: Operations, Administration and Maintenance

Energy Efficiency - Introduction



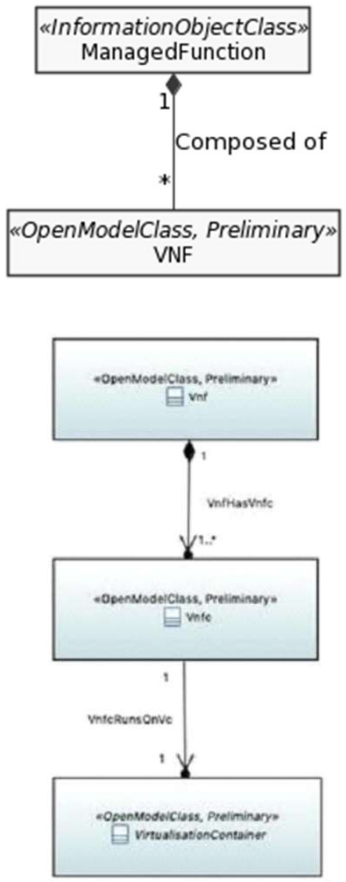
Energy Efficiency - Metering the Energy Consumption (legacy radio access networks)

- Based on ETSI ES 202 336-12 (applies to non-disaggregated non-virtualized base stations)



Energy Efficiency - Metering the Energy Consumption (virtualized networks)

- Performance is measured per 5G Network Function
- Working assumptions:
  - A **5G Network Function can be composed of Physical Network Functions and/or Virtualized Network Functions**
  - **A VNF** can be composed of multiple VNFCs, **on multiple servers**
  - **A server can support multiple VNFCs, from different VNFs**
  - **The finest grain to measure the Energy Consumption is the server**
- The Energy Consumption of VNFCs is **estimated** based on their relative mean virtual CPU usage collected from NFV MANO

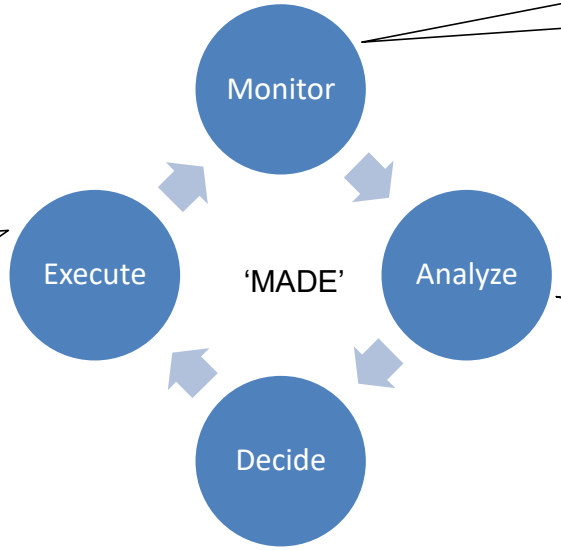


VNF: Virtualized Network Function
VNFC: Virtualized Network Function Component

Energy Saving

- Actions taken by the MNO to reduce the energy consumed by the 5G system
- Generally happens when traffic is low

Examples of actions:
- ✓ Activate sleep mode(s)
- ✓ Switch off/on network resources (e.g. Network Function, cell)
- ✓ Adapt / Reconfigure air interface transmission parameters
- ✓ Scale down/up virtualized resources (→ NFV MANO)
- ✓ Relocate network functions (e.g. UPF)
- ✓ Redirect traffic



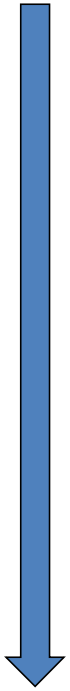
Collects:
- Performance measurements
- Energy Consumption measurements

Possible AI/ML assistance (with or w/o prediction)

MANO: Management and Orchestration
UPF: User Plane Function

Energy Saving (cont'd)

- MADE loop at various levels:
  - **Locally** (e.g. at base station level)
  - At **domain-specific OA&M** level (e.g. RAN EMS, CN EMS)
  - At **cross-domain OA&M** level



- ✓ Near real-time
- ✓ Local vision, local impact
- ✓ Possible interferences

- ✓ Non real-time
- ✓ End-to-end vision, broader impact

EMS: Element Management System

Digital Sobriety

- Actions not taken by the MNO

- **Eco-design** → Make 5G Advanced more digital sober
  - In 3GPP specification work, try to **limit the volume of data to be transported, stored, processed** so as to limit the energy consumed by the 5G system

- **Eco-friendly usage** → Investigate whether business customers could accept (/ volunteer for) limited QoS compromise
  - May apply to e.g. Network Slice as a Service
  - **Customers** may indicate MNOs that they **accept e.g. reduced coverage, bandwidth, augmented latency, etc. for the sake of energy savings**
  - May help large enterprises **limit their Scope 3 emissions** (due to their usage of telecommunication services)

Way forward

- Pursue the work
  - Energy Efficiency
    - Pursue our deep dive into Virtualization (VM / Container)
    - Comprehensive solution for energy consumption metering in RAN sites
    - Address various operation models (Passive RAN sharing, active RAN sharing, etc.)
    - Energy state model
  - Energy Saving
    - New use cases and solutions
  - Digital Sobriety
    - Eco-design
    - Eco-friendly usage
- A **cross-SDO collaboration** would be beneficial to **build comprehensive, consistent and non-overlapping standards**. Candidate SDOs / groups (non-exhaustive) list: 3GPP, NGMN, GSMA, ETSI EE, ETSI NFV, open source projects (?)

Thank you!