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(Growth, Profitability & Nation Building)
13-14th March 2014 • New Delhi, INDIA

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Energy efficiency management and environmental impact assessment for ICTs

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- What is required to define sustainable ICT products/networks/services
- ETSI standards for:
  - environmental impact assessment
  - measurement of energy efficiency
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  - Improving energy efficiency and using of alternative energy solutions
- ETSI Key Performance Indicators for energy efficiency

WHAT IS REQUIRED TO DEFINE SUSTAINABLE ICT PRODUCTS/NETWORKS/SERVICES

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What is required to define sustainable ICT products/services/networks?

- Methodologies to determine the environmental impact assessment (e.g. GHG, resource consumption etc)
- Methods to determine the power consumption of ICTs to be used as input data for the environmental impact assessment
- Methodologies to monitor and manage the energy efficiency
- Guidelines for the realization of “green” installations
- Key Performance Indicators for products/installations

ETSI STANDARD FOR ENVIRONMENTAL IMPACT ASSESSMENT

Life Cycle Assessment

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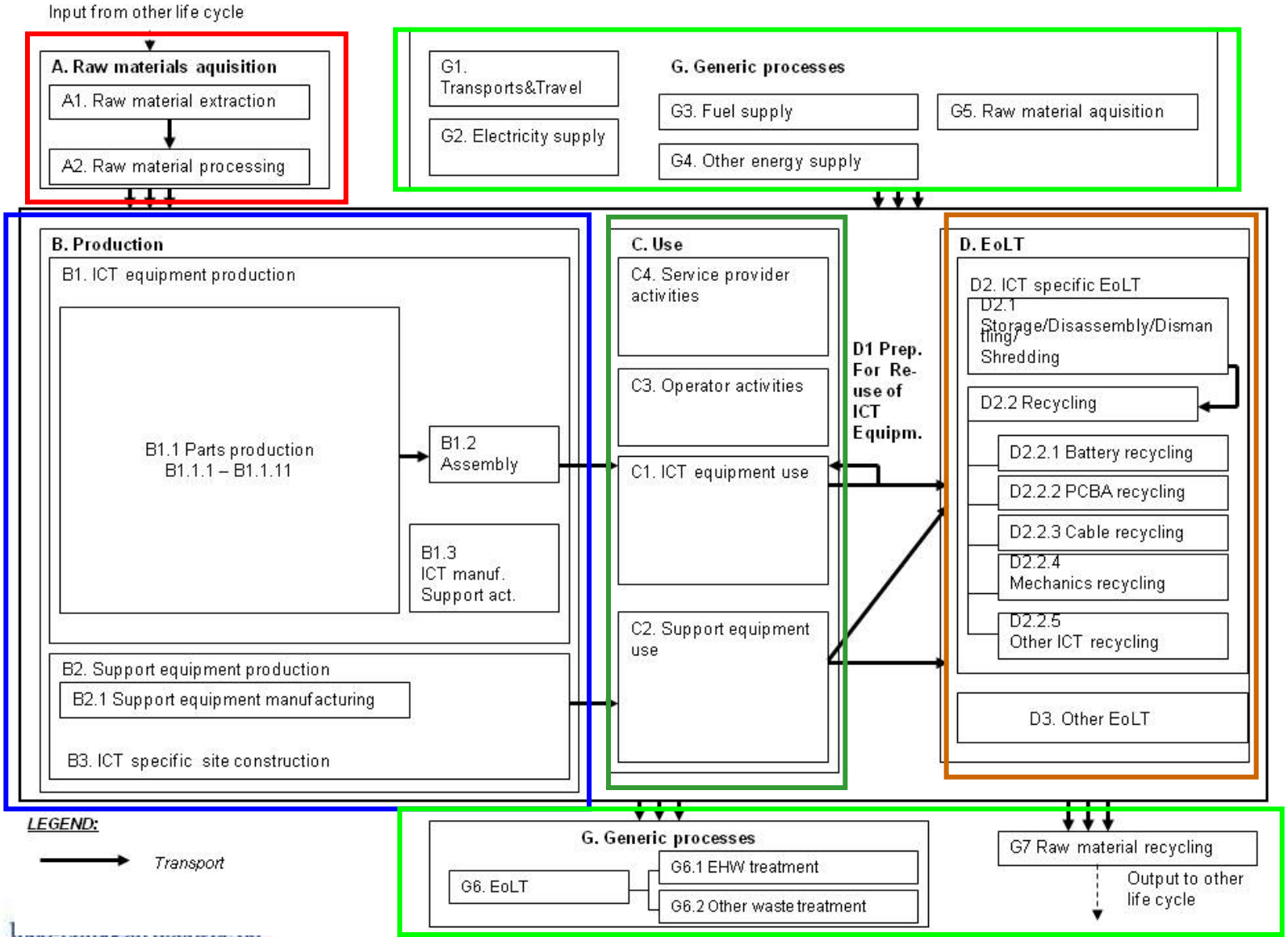
Methods for assessing the environmental impact of ICTs

- TS 103 199 V1.1.1 “Life Cycle Assessment of ICT equipment, ICT network and service: General definition and common requirement”
- Published (11/2011)
- The purpose of this TS is to harmonize the LCA of ICT:
  - Equipment
  - Networks
  - Services
- It includes specific requirements for LCA of ICTs in respect to:
  - ISO 14040 Environmental management, Life cycle assessment, Principles and framework
  - ISO 14044 Environmental management, Life cycle assessment, Requirements and guidelines
  - International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment

Life Cycle Assessment



Methods for assessing the environmental impact of ICTs: the improvement

- TS 103 199 was evaluated during the European Commission pilot test
- During the pilot test, some questions have been raised that allowed to identify the strengths and weaknesses of the ETSI LCA document
- TS is currently under revision for improvement and upgrade to ES
  - Provide more guidance for recycling allocation rules
  - Clarification on how to assess the LCA uncertainty
  - More guidance/clarifications on Network and Service LCAs
  - Clarify applicability of annexes when only GHG emissions are assessed
- This Work Item is a joint activity ITU-T SG5/WP3

ETSI STANDARDS FOR MEASUREMENT OF ENERGY EFFICIENCY

Measurement methods of ICT products and networks

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ETSI standards to determine energy efficiency

These standards are used to determine the power consumption to be used in the LCA analysis

- **Customer Premises Equipment**
  - **EN 301 575 V1.1.1, 5/2012**
  - end-user broadband equipment in the scope of EU regulation 1275/2008
- **Wireless Broadband Access equipment**
  - **TS 102 706 V1.3.1, 7/2013**
  - Under revision to enhance test method in traffic conditions
- **Switching and router equipment**
  - **ES 203 136 V1.1.1, 05/2013**
- **Wireline Broadband Access equipment**
  - **ES 203 215 V1.3.1, 10/2011**
  - Under revision to include new technologies
- **Core network equipment**
  - **ES 201 554 V1.1.1, 04/2012**
  - Equipment defined in TS 123 002
  - Under revision to include Radio access control nodes
- **Transport equipment**
  - **ES 203 184 V1.1.1, 03/2013**
- **Mobile networks**
  - **ES 203 228 in preparation**

ETSI STANDARD FOR ENERGY MANAGEMENT

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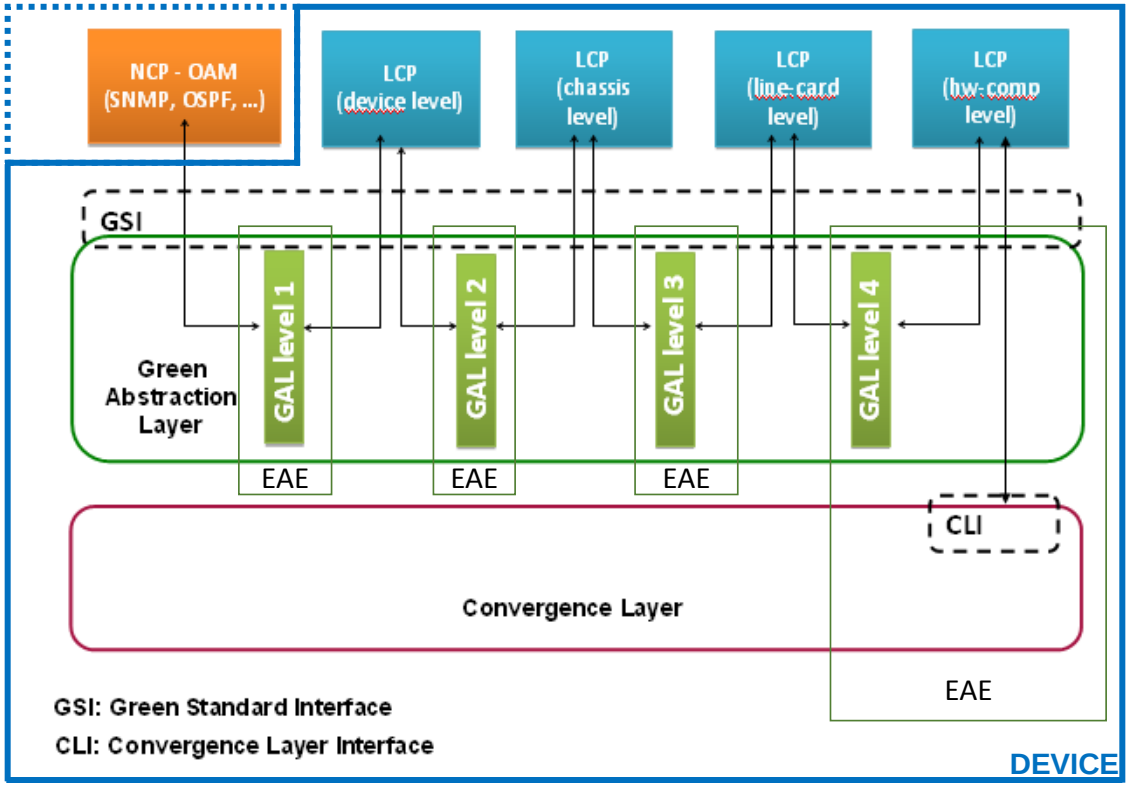
Green Abstraction Layer ES 203 237

- Green Abstraction Layer (GAL) is a novel way for managing and monitoring energy and performance profiles of device hardware.
- GAL is an interface between data and control planes for exchanging data regarding the power status of a device.
- GAL addresses three main sets of control plane processes:
  - Local Control Policies (LCPs), which optimize the configuration at the device level, in order to achieve the desired trade-off between energy consumption and network performance, according to the incoming traffic load. For this purpose, such processes need to know in detail the internal architecture of the device (or parts thereof), the number, the typology and the capability of energy-aware elements, as well as to have access to network performance indexes.
  - Network Control Policies (NCPs), to autonomously control and optimize the behaviour of a network. Typical examples of this kind of processes are traffic engineering, routing and signalling algorithms/protocols (e.g. OSPF-TE/RSVP-TE) with "green" extensions.
  - Monitoring and Operation Administration & Management (OAM), for the operator to control and optimize the trade-off between energy consumption and network performance through a network management system with "green" capabilities.

Green Abstraction Layer ES 203 237



- EAE Energy Aware Entity
- LCP Local Control Policy
- NCP Network Control Policy
- OAM Operations, Administration & Management
- OSPF-TE Open Shortest Path First - Traffic Engineering

ETSI STANDARDS ON ENERGY EFFICIECY MONITORING

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Energy efficiency monitoring

- Series of standards published by ETSI TC-EE on "Infrastructure equipment control and monitoring system interface" (ES 202 336-x series)
- Control processes defined in these publications aims to reduce the energy consumption by optimizing settings of utilities in the TLC infrastructure (e.g. cooling systems, power systems etc.)
- Remote monitoring and setting reduce CO2 emissions (less on-site interventions)

Energy efficiency monitoring: the publications

- ES 202 336-x: “Infrastructure equipment control and monitoring system interface” series
  - “1” General interface (V1.2.1, 07/2011)
  - “2” DC power systems (V1.1.1, 03/2009)
  - “3” AC-UPS power systems (V1.1.1, 10/2009)
  - “4” AC distribution power system (V1.1.1, 03/2013)
  - “5” AC-diesel backup generators (V1.1.1, 04/2010)
  - “6” Air conditioning systems (V1.1.1, 09/2012)
  - “7” Other utilities (V1.1.1, 12/2009)
  - “8” Remote power feeding (V1.1.1, 09/2009)
  - “9” Alternative power systems (V1.1.1, 09/2012)
  - “10” AC inverter power system control (V1.1.1, 09/2011)
  - “11” Battery systems (in preparation)
  - “12” Telecommunication equipment (in preparation)

Energy efficiency monitoring; ICT equipment

- prES 202 336-12 (DES/EE-02037-12) on "Monitoring and Control Interface for Telecom/ICT equipment Power, Energy and Environmental parameters"
- It defines the control/monitoring interface of telecommunication/ICT equipment to keep under control the power consumption and environmental values
- Parameters to be monitored are:
  - power consumption
  - environmental parameters (e.g. temperature)
  - Traffic/data parameters (throughput, number of connected lines, radio setting, etc)

ETSI STANDARDS ON EFFICIENT POWER ARCHITECTURE FOR DATA CENTRES

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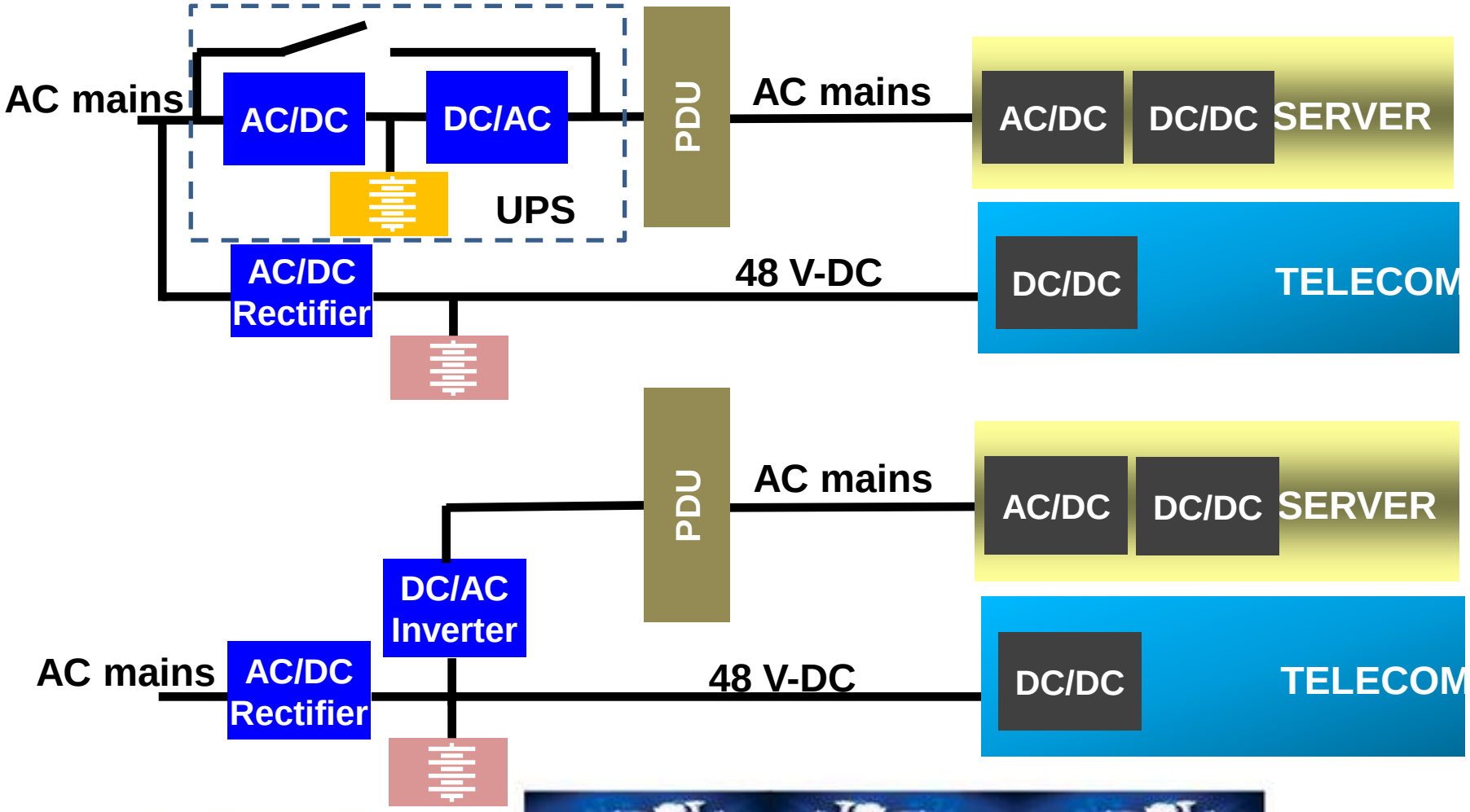
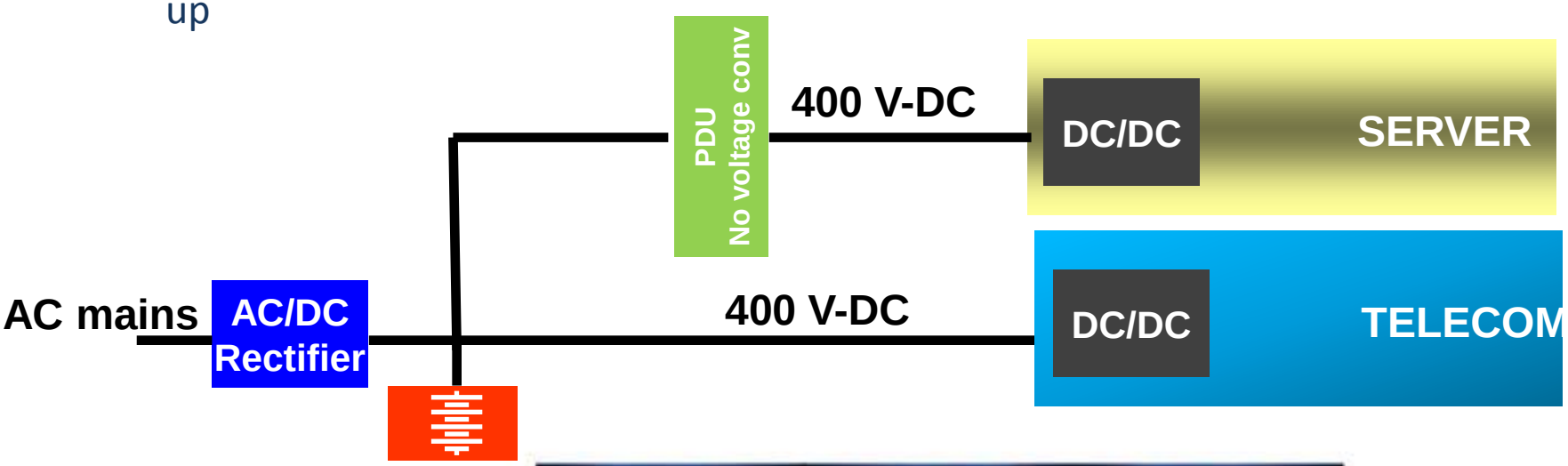
The “classical” power architectures

- Data centers with telecom equipment at 48 V-DC and data equipment at AC mains power (e.g. 380 V or 220 V AC) needs a more efficient power distribution



Power architecture with better energy efficiency

- A power distribution at 400 V-DC has more efficiency
  - Less conversion stages in the overall system
  - Less losses on cables
- And …
  - Longer battery back-up without system de-rating
  - No harmonic losses and effects on distribution
  - No need for load balancing between phases
  - Smaller footprint
  - Suitable to supply all type of equipment in a data center without using UPS as back-up



Power architecture with better energy efficiency: the standards

- ETSI TC-EE has produced the standards for the power supply interface requirements of equipment to be connected to a 400 V-DC power distribution:
  - EN 300 132-3-1, V2.1.1 (02-2012): Direct current source up to 400 V

- EN 301 605 V1.1.1 “Earthing and bonding of 400 V-DC data and telecom (ICT) equipment”

ETSI GUIDELINES TO IMPROVE ENERGY EFFICIENCY AND USE OF ALTERNATIVE ENERGY SOURCES

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GUIDELINES FOR IMPROVEMENT OF ENERGY EFFICIENCY AND ALTERNATIVE ENERGY SOURCES

TR 102 530 V 1.2.1 (07/2011): "The reduction of energy consumption in telecommunications equipment and related infrastructure"

TR 102 532 V 1.2.1 (11/2012): "The use of alternative energy sources in telecommunication installations"

- It includes an overview of the alternative energy sources and guidelines for its use (both for powering and cooling)
- Disposal of waste materials
- LCA analysis related to alternative energy solutions (e.g. batteries)

DTR/EE-02042 (in progress): "Safety Extra Low Voltage DC power supply network for customer ICT devices with renewable energy and energy storage options"

- Improved efficiency with less conversion stages
- Reduction of CO_2 emissions using renewable energy options

ETSI KEY PERFORMANCE INDICATORS FOR ENERGY EFFICIENCY

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Key Performance Indicators for ICT products/network/installations

- KPI for energy consumption
  - This is the total consumption of energy by an operational infrastructures.
- KPI task efficiency = energy/service unit
  - The indicator for task efficiency is the assessment of the work done (as a result of design and/or operational procedures) for a given amount of energy consumed.
- KPI heat reuse= reused energy / consumed energy
  - This parameter addresses the energy re-use in terms of transfer or conversion of energy (typically in the form of heat) produced by the operational infrastructure to perform other work.

Key Performance Indicators for ICT products/network/installations

- KPI renewable energy= renewable / consumed energy
  - This addresses the renewable energy produced from dedicated generation systems using resources that are naturally replenished.
- KPI Global Indicator
  - This KPI allows benchmarking the energy management of ICT nodes (data centres included) depending on their size in terms of energy consumption.

KPIs are defined in the ETSI standards ES 205 200 series produced by TC-ATTM

THANK YOU!

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