ETSI IoT Week 2022

IoT and Edge Computing Carbon Footprint Measurement Methodologies

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AIOTI

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Main objectives

➔ Information and insights on ***Carbon Footprint Measurement Methodologies*** and their relation to EU Green Deal regulations

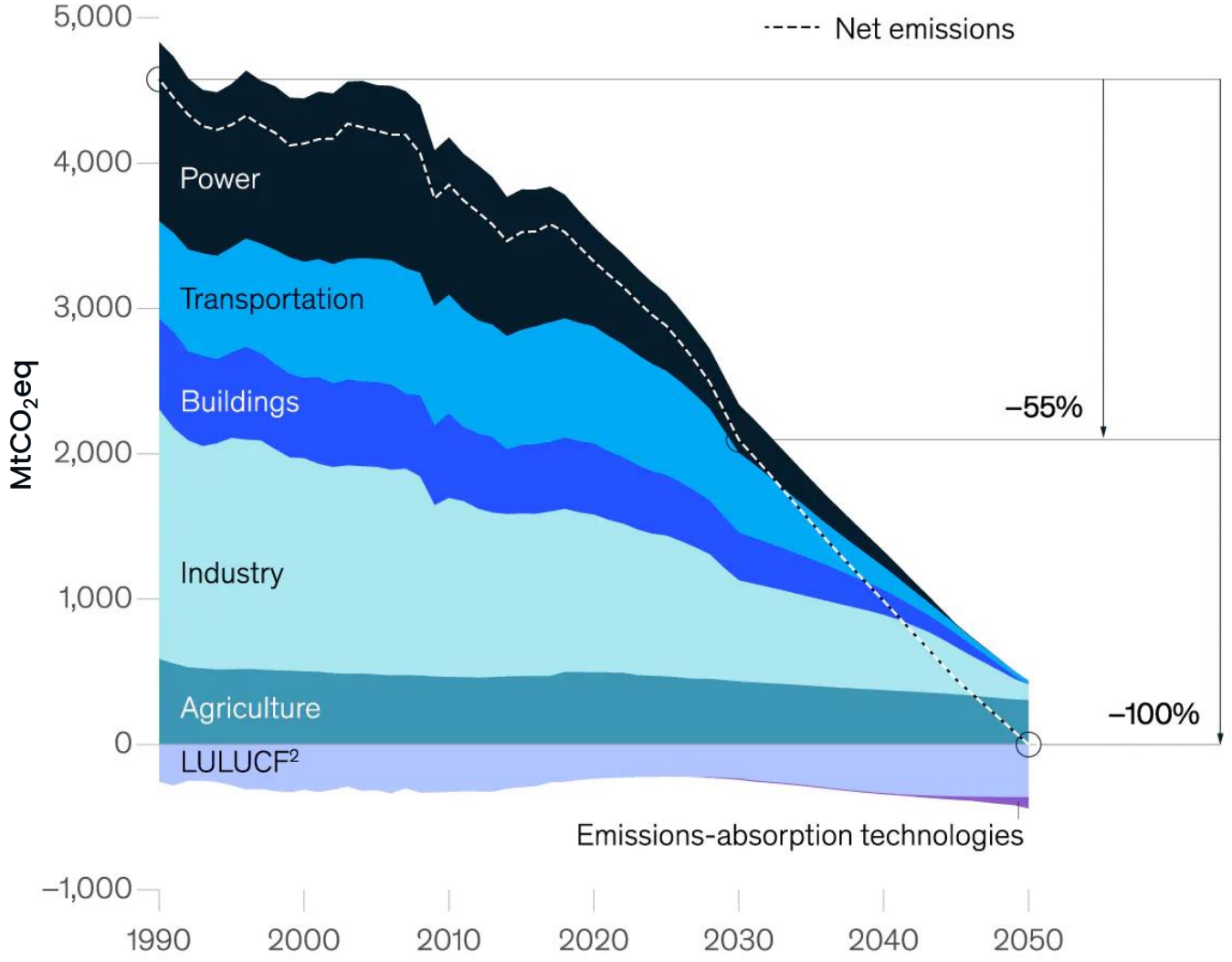
➔ Contribution of IoT and Edge to carbon footprint reductions and measurement of their impact - based on the AIOTI report: "**IoT and Edge Computing Carbon Footprint Measurement Methodology**", **Release 1.0**

Climate neutral – the pathway to Net Zero Europe

Total GHG emissions per sector – 1.5° scenario

- ➔ Decarbonization pathway to a net-zero Europe
- ➔ Reduce EU´s emissions 55% by 2030 compare to 1990 levels
- ➔ Reaching net-zero by 2050

Differenciation by sectors: speed depends on the availibilty of nature technology and the ability to scale supply chain



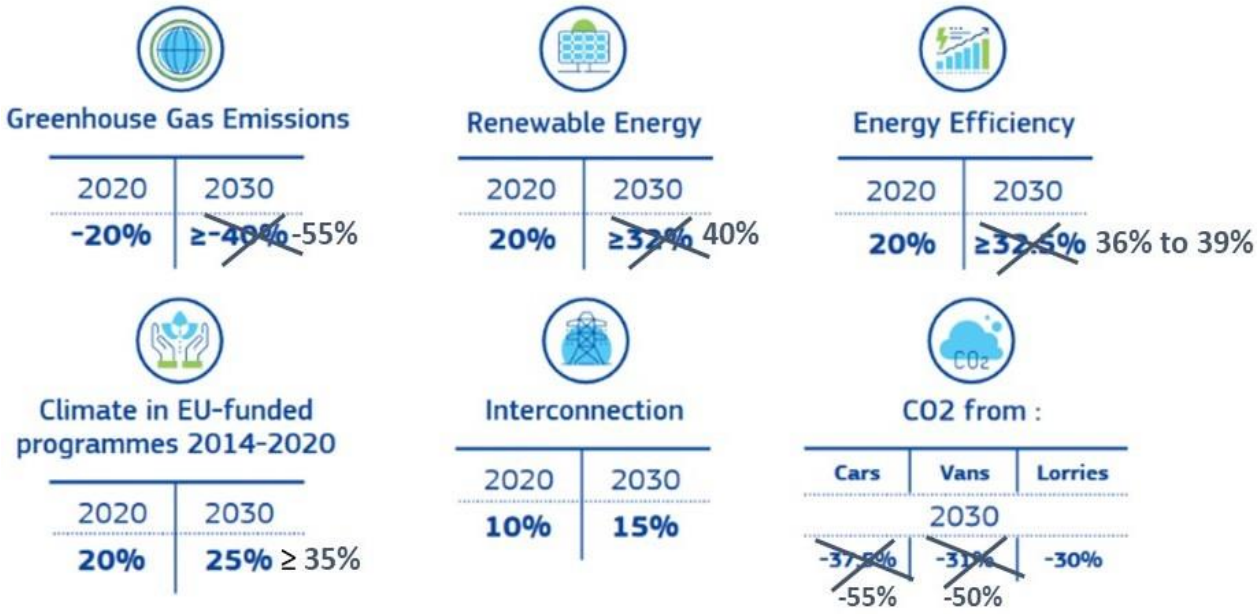
Source: UNFCC; McKinsey analysis

[2]LULUCF: Land use, land-use change, forestry entails

EU Green Deal regulations – Fit for 55

➔ package of proposals to make the EU's climate, energy, land use, transport and taxation policies fit for reducing net greenhouse gas emissions by at least 55% by 2030, compared to 1990 levels

The European Commission states: "Europe must leverage the potential of digital transformation, which is a key enabler for reaching the Green Deal objectives."



Updated EU-Energy and Climate Targets Fit for 55

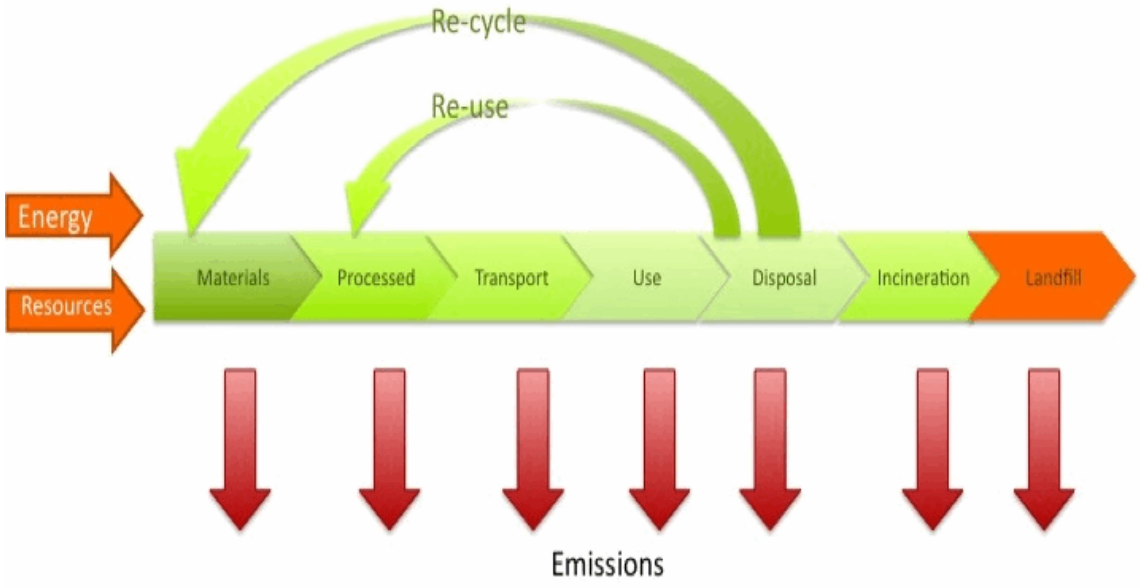
How to address the green digital transformation

➔ Formalize green transformation effort

➔ Integrate the efforts into companies´s business strategy

Goal: consistent, comparable and transparent information on climate and other Environmental, technical, Social and corporate Governance (ESG) information

Sustainability issues



Life Cycle Assessment (LCA)

Environmental issues
Circular economy

Carbon footprint measurement methods of **products**, of **services**, of **Verticals**

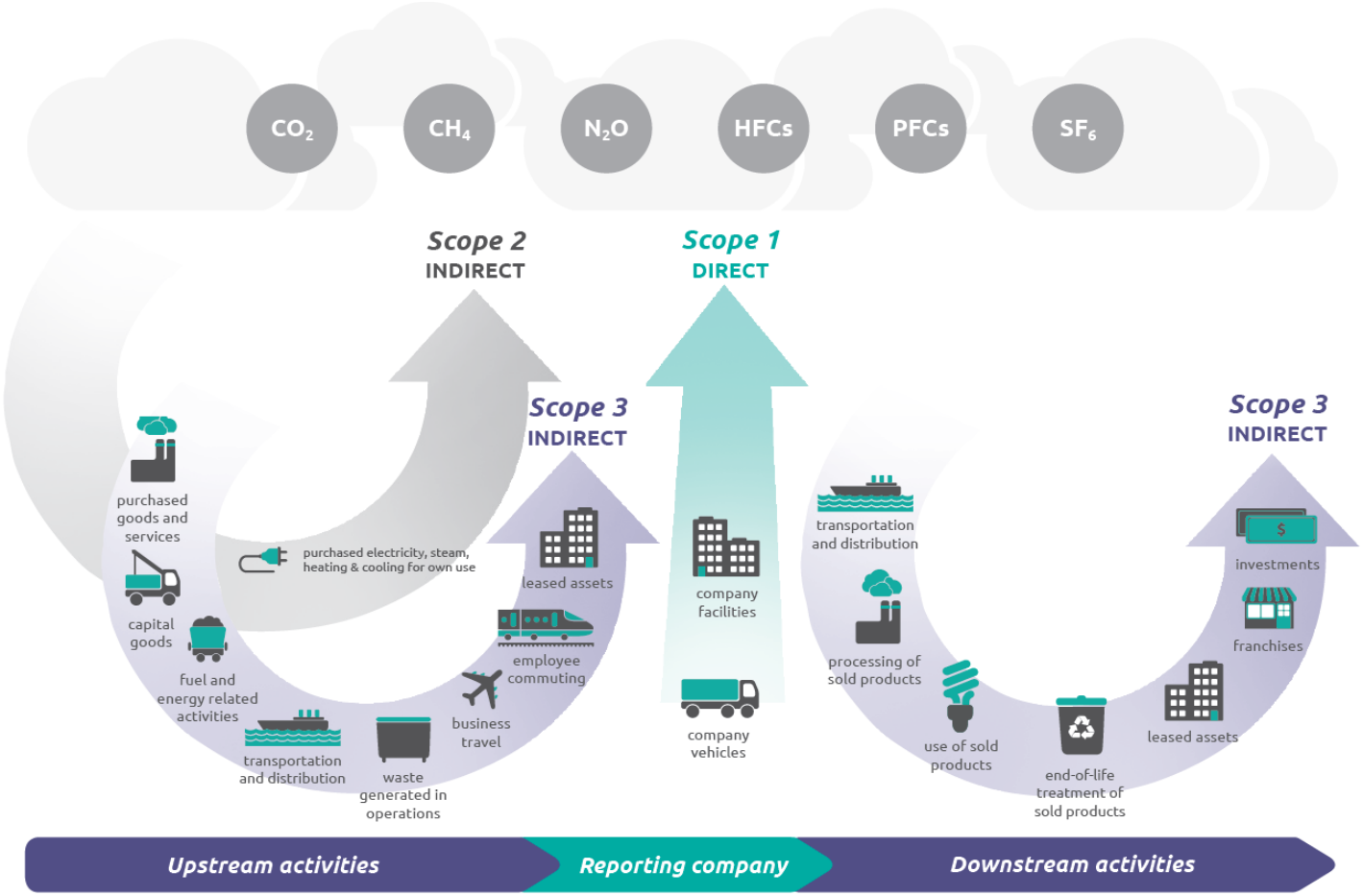
Energy savings´ technical and assessment methods

Science Based Targets - SBT

Science Based Targets Initiative:

- Established in 2015
- Sets emission reduction targets in line with Paris Agreement goals
- Developed and launched the world's first **net zero** standard

➔ Best practice for companies:
Adopt transition plans covering **scope 1, 2 and 3 emissions**,
Set out **short-term milestones**,
ensure effective board-level governance and
Link executive compensation to the company's adopted milestones.



Overview of GHG Protocol scopes and emissions across the value chain, Source: GHG Protocol

Overview of current Carbon Footprint Measurement Methodologies

Product Environmental Footprint Methods	ISO 14044: Environmental Management: Life Cycle Assessment
	ISO 14067: Carbon Footprint of Product
	International Life Cycle Data (ILCD)
	GHG protocol: Product Life Cycle Accounting and Reporting Standard
	Publicly Available Specification (PAS) 2050 / 2060: UK's Product Carbon footprint
	Ecological footprint: amount of the environment necessary to produce the goods and services necessary to support a particular lifestyle
	BPX 30-323: French Environmental Footprint Guidance
	Product Environmental Footprint (PEF) method: Life Cycle Assessment (LCA) based method to quantify the environmental impacts of organizations
Corporate Environmental Footprint Methods	ISO 14064: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals
	Global Reporting Initiative (GRI): sets out principles and performance indicators that organizations can use to measure and report their economic, environmental, and social sustainability performance
	CDP Water Disclosure Project
	GHG protocol: Corporate Standard - standards and guidance for companies and other types of organizations preparing a GHG emissions inventory
	International Life Cycle Data (ILCD)
	Defra: Guidance on how to measure and report your greenhouse gas emissions
	Defra: Guidance on Environmental Key performance Indicators – Reporting Guidelines for UK Business
	Bilan Carbone: organizational GHG accounting guidance document and tool produced in France by ADEME
	Organisation Environmental Footprint (OEF) method
Specific Carbon Footprint Methods	Science-Based Targets: robust approach for companies to manage their emissions over the long haul
	Green House Gas Protocol, used in the context of SBTs

Selection criteria for methodologies on measuring carbon footprint

1. It´s recommended to use one of the standardised methods, prioritising international/global standardised methods
2. Should SBTi targets be covered? If yes, depends on covering SBTi Scope1 and/or SBTi Scope 2 and/or SBTi Scope 3
3. Depending on the use case and the applied industrial domain
4. What is the goal of measurement (e.g. for the operational purposes, lifecycle, production etc.)
5. Does the methodology need to provide the necessary requirements imposed by the SPI/Product Passport regulation?
6. In addition to carbon footprint, is there a requirement to measure as well the electrical energy footprint?

Overview of ICT Methods of measuring Carbon Footprint

Document	Target group	Scope
©GeSI, ITU-T, GSMA, SBTi: "*Guidance for ICT companies setting science-based targets*"	mobile/fixed networks operators and data centres operators	scope 1,2,3
Recommandation ITU-T L.1470: "*Greenhouse gas emissions trajectories for the information and communication technology sector compatible with the UNFCCC Paris Agreement*"	ICT sector: mobile/fixed networks, data centres, enterprise networks, end-user goods	scope 1,2,3 with long term ambition for 2050
ETSI GS OEU 020: "*Operational energy Efficiency for Users (OEU); Carbon equivalent Intensity measurement; Operational infrastructures; Global KPIs; Global KPIs for ICT Sites*", for data centers, for fixed networks and for mobile networks	(not limited to) data centres and operator sites	Carbon usage performance due to energy usage by operational infrastructures in ICT sites, for data centers, for fixed networks and for mobile networks
ETSI ES 203 228: "*Assessment of mobile network data energy efficiency*"	mobile/fixed network operators	metrics and methods for assessing (and measuring) energy efficiency in operational networks
ITU T L.1333 (ex L.NCIe): "*Carbon Data Intensity for network energy performance monitoring*"	mobile/fixed network operators	Carbon metrics for telecommunication networks, focusing on Network Carbon Intensity (NCI)
NGMN: "*Green Future Networks: Sustainability Challenges and Initiatives in Mobile Networks*"	mobile/fixed network operators	Carbon Intensity that shows the CO_2 emissions in proportion to the transmitted data volumes in Tera Bytes
"*On Global Electricity Usage of Communication Technology: Trends to 2030*"	use and production of consumer devices, communication networks and data centers	electricity usage of communication
"*Green IoT and Edge AI as Key Technological Enablers for a Sustainable Digital Transition towards a Smart Circular Economy: An Industry 5.0 Use Case*"	research on sustainable ICT	Measuring/Evaluate Green IoT and Edge AI Carbon Footprint

Selection criteria for methodologies on measuring the benefit of IoT and Edge Computing for Carbon Footprint reduction in industrial domains

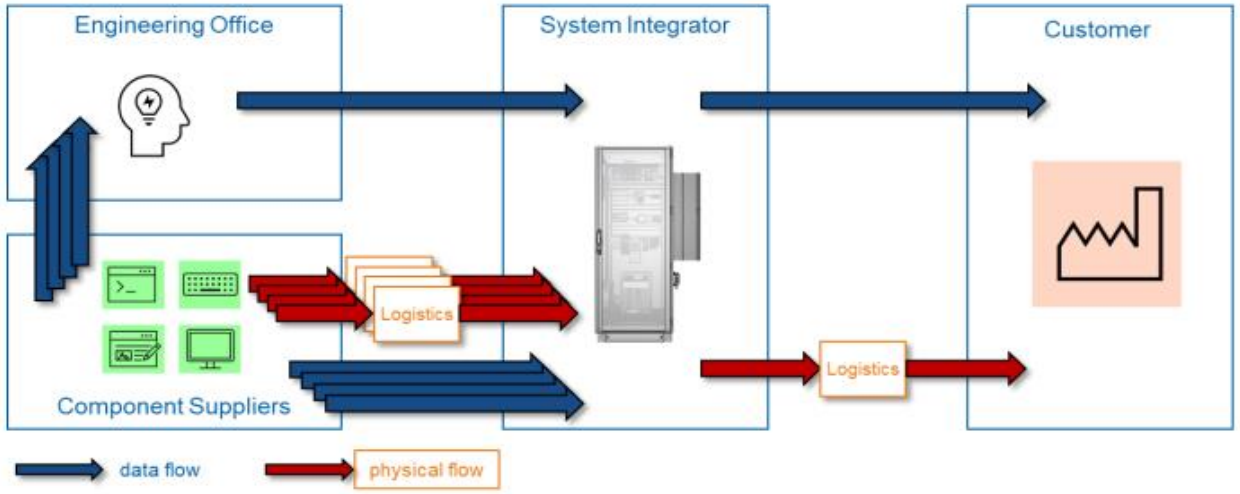
1. It´s recommended to use one of the standardised methods, prioritising international/global standardised methods
2. Depending on the IoT and Edge Computing Infrastructure to be used to reduce the carbon footprint
3. In addition to carbon footprint, is there a requirement to measure as well the electrical energy footprint?
4. Should SBTi targets be covered? If yes, depends on covering SBTi Scope1 and/or SBTi Scope 2 and/or SBTi Scope 3
5. Depending on the use case and the applied industrial domain
6. What is the goal of measurement (e.g. for the operational purposes, lifecycle, production etc.)
7. Does the methodology need to provide the necessary requirements imposed by the SPI/Product Passport regulation?

ZVEI-Show-Case "PCF@Control Cabinet“ - Example of selected methodology to measure Carbon Footprint in Smart Manufacturing

Goal of ZVEI-Show-Case "PCF@Control Cabinet“

A flexible, efficient and future-proof concept for the technical implementation of a digital product passport and demonstrates its feasibility using a demonstrator

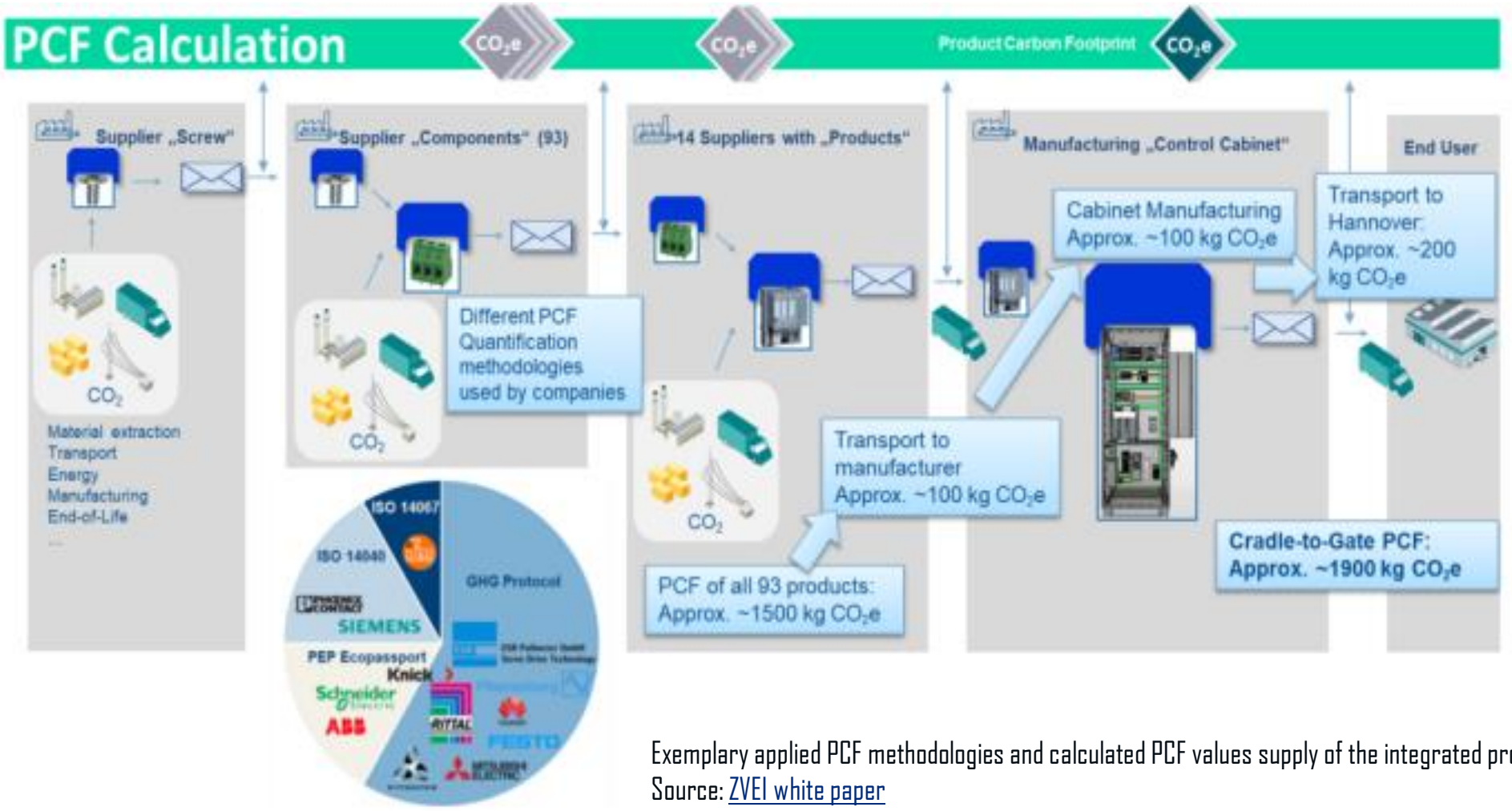
It has been presented at the Hannover Messe event in Germany during 30 May – 2 June 2022, where the product carbon footprint of a control cabinet is calculated



Data and component flow in the system integration process
Source ZVEI white paper

CAD-model of the control cabinet presented at the Hannover Fair 2022
Source ZVEI white paper

ZVEI-Show-Case "PCF@Control Cabinet“ – Example of selected methodology to measure Carbon Footprint in Smart Manufacturing



Exemplary applied PCF methodologies and calculated PCF values supply of the integrated product
Source: ZVEI white paper

Recommendations & conclusion

- **Smart use** of **clean digital technologies** can serve as a **key enabler** for climate action and environmental sustainability
- **Technology** can improve energy and resource efficiency, facilitate the circular economy, lead to a better allocation of resources; reduce emissions, pollution, biodiversity loss and environmental degradation
- The ICT sector must **ensure** the environmentally sound design and deployment of digital technologies by minimising the ICT (IoT and Edge computing) carbon footprint:
  - **Measurement of the benefits** provided by ICT in carbon reduction is a struggle ➔ initiatives as EGDC can help
  - Use of **standardised connectivity related metrics/parameters** related to carbon footprint, in order to be used by stakeholders to compare and evaluate the benefit of different connectivity solutions in reducing the carbon footprint of industrial sectors
  - Include scope3 impacts in the CO2e footprint calculation
- How to enable the **DPP (Digital Product Passport)**? Depending on the sectors involved, IoT and Edge computing are important enabling technologies for this realisation:
  - A possible implementation for technical industries, is provided by ZVEI, using the DPP4.0 concept, based on DNP4.0 (Digital Name Plate 4.0) and AAS (Asset Administration Shell). For consumer goods, ISO standards play an important role to facilitate interoperability and increased transparency along the chain
- Not all PCF calculation methods are equivalent and comparable; **Selection criteria** are needed to help stakeholders to select the most suitable PCF methodology for each considered scenario and industry sector
- Usage of digital technologies (e.g. monitoring and controlling energy usage) for **an indirect reduction of greenhouse emissions** due to, as an example, manufacturing
- An important path to realise carbon reduction is **to increase awareness and information** for the citizens to reduce energy and carbon footprint and **increase the incentives** for citizen to realize this reduction

IoT Week 2022

Q&A time

Also email sg@aioti.eu

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