ETSI
The Standards People

IoT Conference 2023

Steps Towards Calculating Avoided Carbon Emissions in Industrial Sectors, when Applying ICT

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Alliance for IoT and Edge Computing Innovation

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Main Objectives

- **Information and insights** on measuring the total avoided carbon emissions in industry scenarios, when applying ICT (IoT and Edge Computing)
- **Contribution of IoT and Edge Computing** as enabling technologies for avoided carbon emissions in industry scenarios and for portfolio PCF (Product Carbon Footprint) reductions - based on the AIOTI report: "IoT and Edge Computing Carbon Footprint Measurement Methodology", Release 1.1
- **Provided as AIOTI input** to European Green Digital Coalition (EGDC)

Green ICT vs ICT for Green

Green ICT

Minimising the environmental footprint of the ICT sector

Examples

- Energy efficiency of datacenters
- Lifespan of electronic equipment
- Transparency on the carbon footprint of ICT infrastructure
- 'eco-labelling' and green public procurement
- IoT and Edge computing – processing where the data is

ICT can reduce 7-10x more GHGs than it's own footprint

ICT for Green

Enabling energy and resource efficiencies (circular economy) in other sectors

Examples

- Digitalisation for stable decarbonized energy grids
- Precision farming, digital for agri-food
- Climate smart cities & communities
- Smart mobility, energy efficiency of buildings
- Sustainable manufacturing and waste treatment
- Extreme weather and climate impact modelling

***Source**: European Commission*

Science Based Targets - SBT

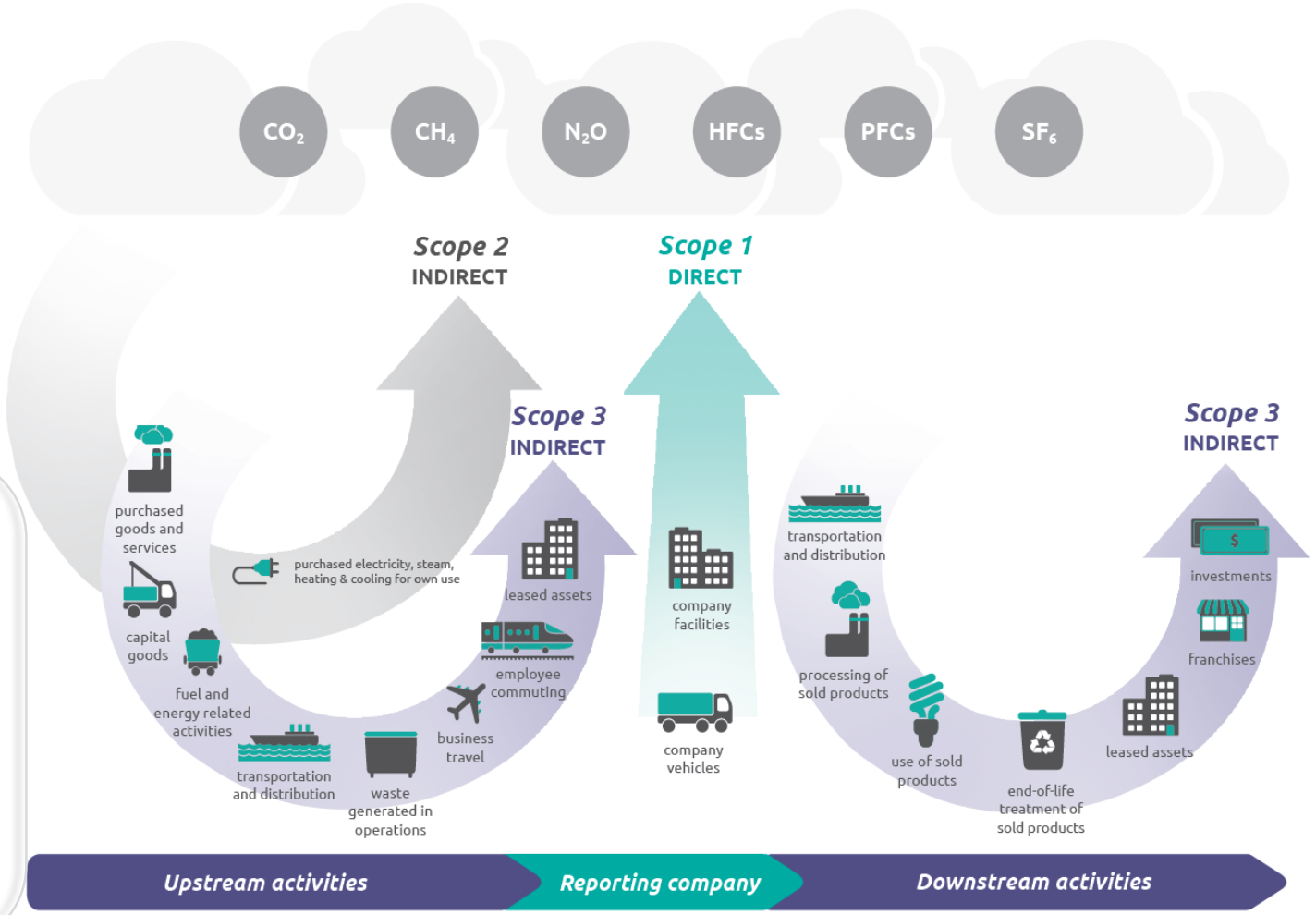
Science Based Targets Initiative:

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

⇨ **Scope 1** = the emissions from owned or operated assets

⇨ **Scope 2** = the emissions from purchased energy

⇨ **Scope 3** = the emissions from everything else (suppliers, distributors, product use, etc.)

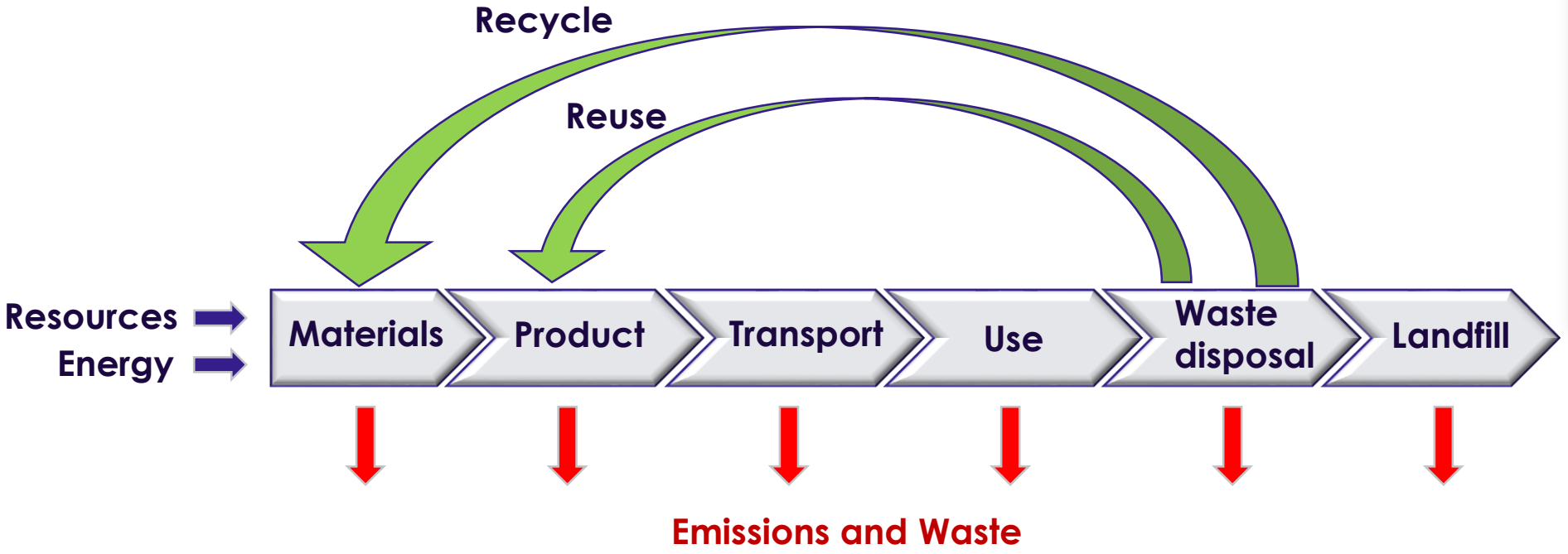


Overview of GHG Protocol scopes and emissions across the value chain, Source: GHG Protocol

AICTI

Life Cycle Assessment (LCA)
Carbon Footprint measurement method – Scope 3

Life Cycle



LCA phases

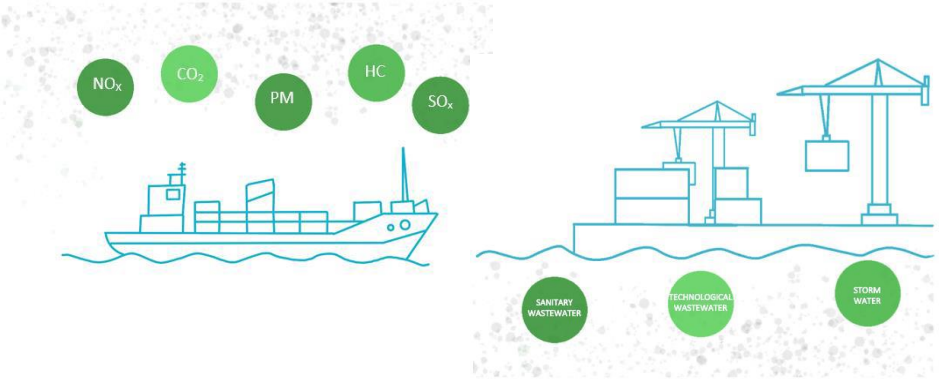
1) Goal and Scope
2) LC Inventory Analysis
3) LC Impact Assessment
4) Interpretation of results

ISO Standard 14040/14044

Source: Journal of Cleaner Production 277:123741, August 2020, "Circular business models: A review", DOI:10.1016/j.jclepro.2020.123741

Current objectives tackled with ICT

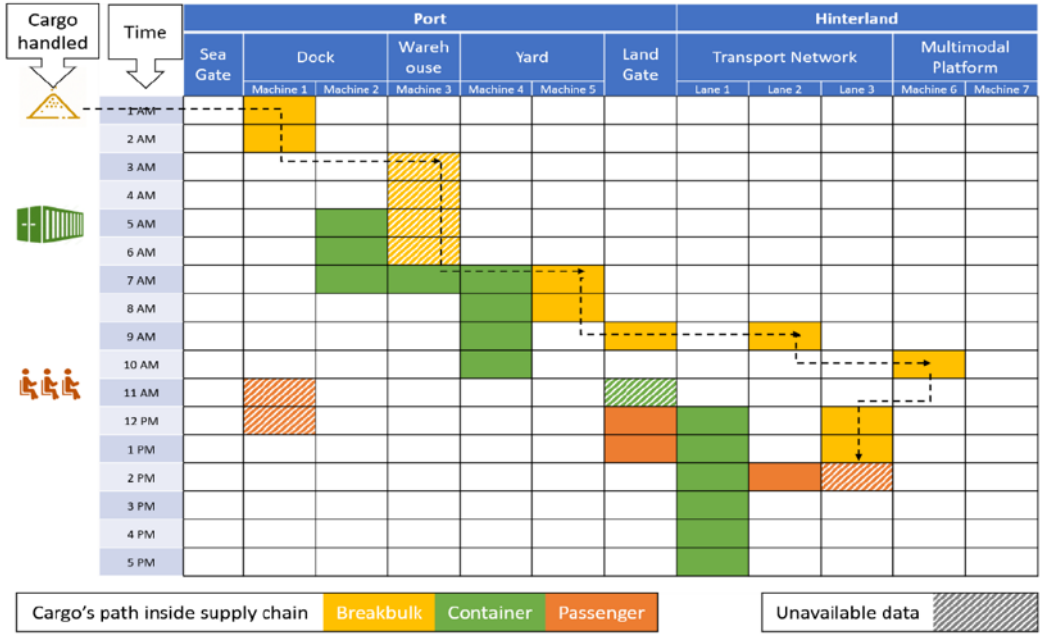
- **Obj1-Interoperability:** "data is the new gold"
- **Obj2-Monitoring and decision-support:** "If you can not measure it, you can not improve it".
- **Obj3- Data processing**: models (digital twins) and AI algorithms for DSS
- **ICT and carbon footprint:** various industrial applications (e.g. ports – H2020 PIXEL project)
  - PEI (Port Environmental Index): quantitative composite index (ships, terminals, PA)
  - No methodology available
  - Analyse environmental indicators → CO2



AIOTI

ICT and Carbon footprint- use case

- **Models:** analyse the main flow of actions (e.g., supply chain)
  - Build atomic tasks and identify the needed data



Supply Chain

Dock	Sequence
452	{Crane1 > Conv.Belt3 >> ...}
421	{Pump4 > ...}
421	{Pump2 > ...}
310	{Hopper >> Schuller > ...}
...	...

Boat Planning

Start	Type	Tonnage
16/05/18 12:15	Cereal	6502
25/05/18 23:06	Sol.Bulk	15284
29/05/18 16:32	Sol.Bulk	751
02/06/18 05:57	Liq.Bulk	6548
...	...	...

Machine Specification

Energy	Cons.	Debit	Status
Electric	4.5 (kW)	52 (cont./h)	Ok
Fuel B405	15 (L)	32 (T/h)	Ok
Fuel H56	28 (L)	125 (m^3/h)	HS [dates]
Electric	31 (kW)	32 (T/h)	Ok
...	...	...	...

Emission unit

Noise (dB)	CO_2 (g/h)	PM_{10}	...
75	235	75	...
81	203	81	...
78	178	78	...
87	368	87	...
...	...	...	...

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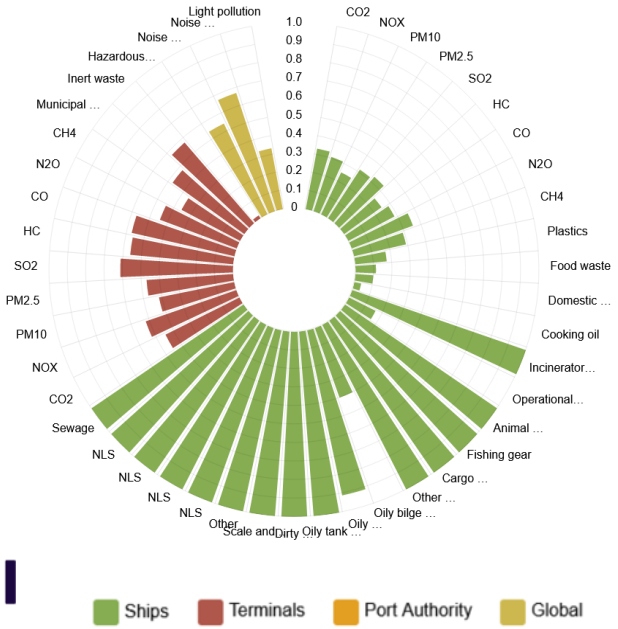
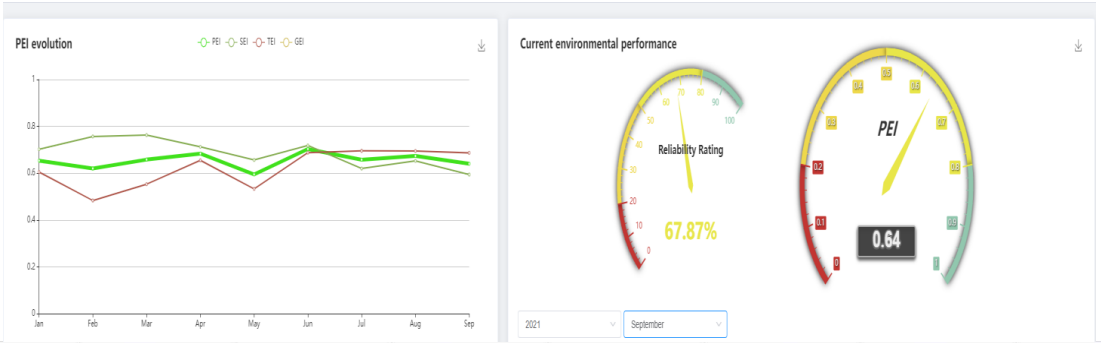
ICT and Carbon footprint- use case

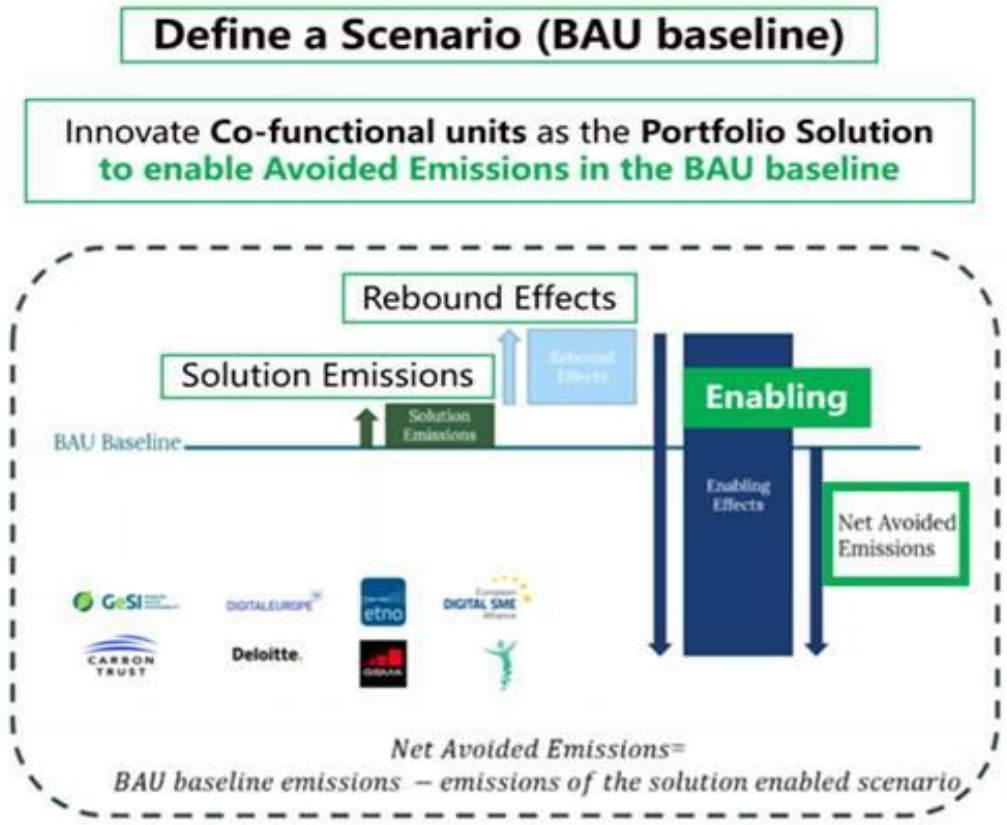
- **Visual tool:** quantify impact and use ICT as reliability metric
- **Further (LCA) analysis**: what was the original emission baseline? How much does ICT contribute to emission improvement? Is it possible to extend the LCA scope beyond the operational phase?





Data origin	Subindex	Piece of data	Optimal retrieval way	Current retrieval way	Reliability Rating	Aggregated RR (subindex)	Aggregated RR (origin)
Ships	Air Emission	IMO number and gross tonnage of ships	Real time API	Periodic API	80.56 %		83.47 %
		Main and auxiliary engine of ships	Periodic API	Average value from literature	36.64 %	67.96 %	
		Berth and maneuvering time of ships	Sensors	Periodic API	86.49 %		
	Waste	MARPOL annexes about waste	Pixel proxy tool	Periodic API	97.14 %	97.14 %	
	Wastewater	MARPOL annexes about wastewater	Pixel proxy tool	Periodic API	85.29 %	85.29 %	
Terminal	Air Emission	Emissions produced by terminal machinery	Sensors	Periodic API	73.47 %	73.47 %	85.42 %
	Waste	Waste produced by the terminals	Pixel proxy tool	Periodic API	97.37 %	97.37 %	
Global	Noise	Noise values (Lden, Lnight, Leq)	Sensors	Average value from literature	34.69 %	34.69 %	30.61 %
	Light pollution	Luminosity (lux)	Sensors	Average value from literature	26.53 %	26.53 %	

European Green Digital Coalition (EGDC) discussions on total avoided carbon emissions, when applying ICT



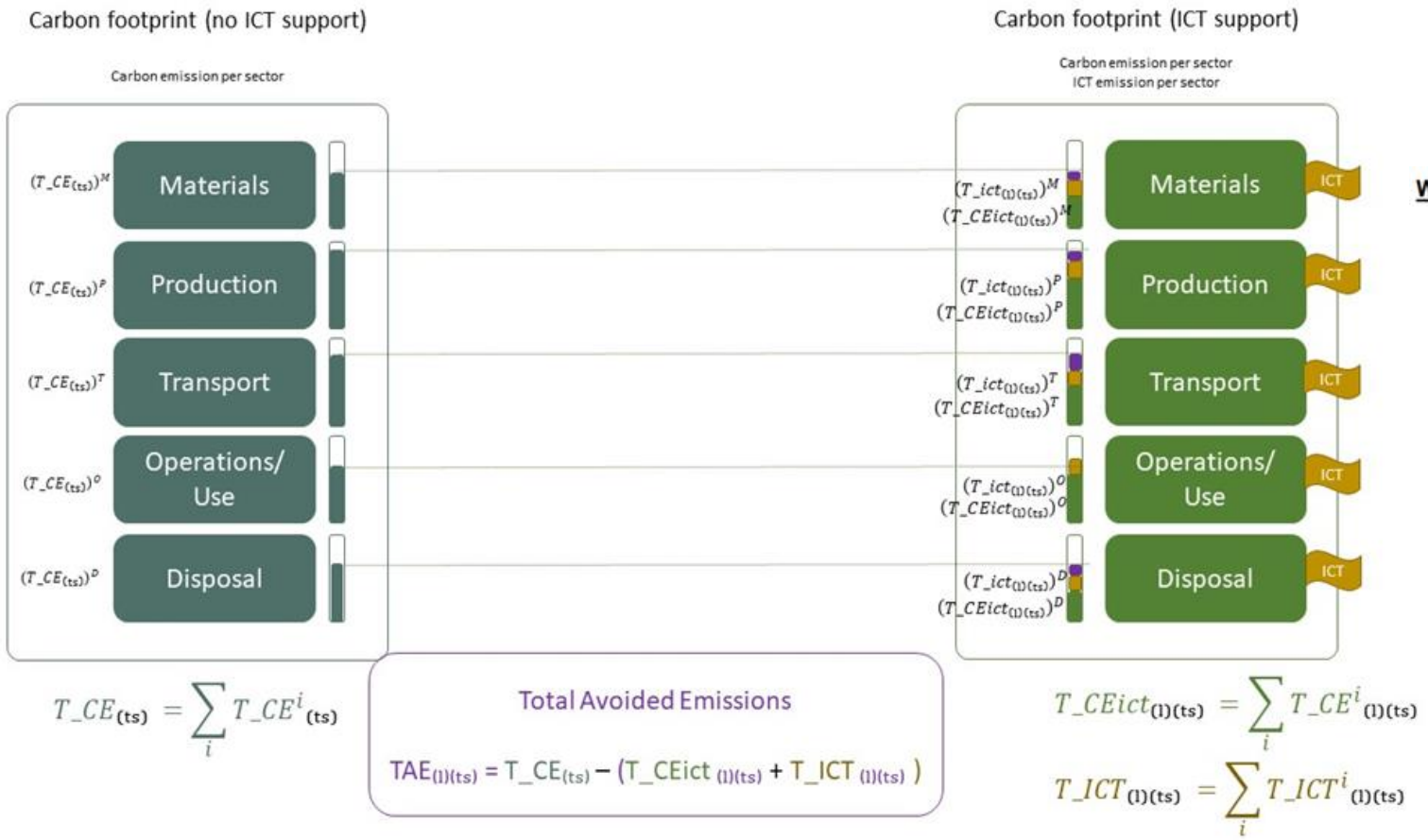
EGDC initiates 3 Scenarios:

- To test the **Net Avoided Emissions effectiveness**
- To Verify the methodology

The aim of the Reporting Working Group will be to discuss and agree on the principles for reporting the avoided emissions of a digital solution.

***Source**: based on EGDC*

AIOTI input on total avoided carbon emissions in vertical sectors, when applying ICT



Source: *AIOTI*

Assumptions:

1. When ICT solutions are used to reduce carbon emissions in Industrial sectors, it is assumed that in the Use/Operation LCA phase the carbon emissions are measured under a certain Load and for a certain type of service;
2. Load = data processed by the network during a unit of time, e.g., 1 year;
3. TS = Type of Service (follow the 5G type of services, e.g., URLLC;
4. LCA = Life Cycle Assessment composed by phases Materials, Production, Transport, Use/Operation, Disposal, excluding the Reuse and Recycle phases;
5. Unit: kgCo2e

Where:

1. $TAE_{(I)(ts)}$: Total Avoided Emission Scenario for: (1) the complete LCA, excluding the Reuse and Recycle phases, (2) for a certain Load and (3) for a type of service, e.g. follow the classification specified by ITU-T for 5G type of services;
2. $T\_CE_{(ts)}$: Total Carbon Emission Scenario, without-ICT-support, for: (1) the complete LCA, excluding the Reuse and Recycle phases, and (2) for a type of service, e.g. follow the classification specified by ITU-T for 5G type of services;
3. $T\_CEict_{(I)(ts)}$: Total ICT Carbon Emission Scenario with ICT-support for: (1) the complete LCA, excluding the Reuse and Recycle phases, (2) for a certain Load and (3) for a type of service, e.g. follow the classification specified by ITU-T for 5G type of services; Note that $T\_CEict_{(I)(ts)}$ is the calculated total carbon emission of the same scenario when ICT is used to reduce the carbon emission in the scenario, but without including the carbon emission of the ICT infrastructure:
4. $T\_ICT_{(I)(ts)}$ Total ICT Carbon Emission Scenario for: (1) the complete LCA, excluding the Reuse and Recycle phases, (2) for a certain Load and (3) for a type of service, e.g. follow the classification specified by ITU-T for 5G type of services. Note that the calculation of the $T\_ICT_{(I)(ts)}$ in the LCA use/operation phase can be realized by using the approach defined in ITU T L.1333.

Recommendations and Conclusions

- **Measurement of the benefits** provided by ICT in carbon reduction is a challenge ➔ initiatives as EGDC
- 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 (CO2 equivalent) footprint calculation (e.g., PCF)
- The ICT sector must ensure the **environmentally sound design and deployment of digital technologies** by minimising the ICT (IoT and Edge computing) carbon footprint (e.g., PCF)

- **Smart use** of **clean digital technologies (green ICT)** 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
  - Usage of digital technologies (e.g. monitoring and controlling energy usage) for **an indirect reduction of greenhouse emissions** due to, as an example, manufacturing
- **The definition of an agreed and aligned methodology** to measure the total avoided carbon emissions in industry scenarios, when applying ICT, is a key requirement for the success of deploying ICT solutions to reduce carbon emissions in industry scenarios
- 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

Next Steps

- **Enhancing the Equation on calculation of avoided emissions** in industrial sectors, when applying ICT with:
  - **Apply the equation in testbeds and in EC funded projects** where AIOTI members are participating
  - **Including impact of recycling and reuse** LCA phases
  - **Aligning with ITU-T SG5 L.1480**, (revised version) and others and ETSI TC EE relevant documents *

* At joint ETSI TC EE and ITU-T SG5 meeting at ETSI premises (13 – 23 June), ETSI TC EE EEPS and ITU-T Q9/SG5 groups approved their cooperation with AIOTI on updating the specifications: L.1480rev, L.1410rev, and L.SimplifiedLCA)

Thank you for listening

Any questions?

You can email us at sg@aioti.eu

AIOTI

Backup Slides – About AIOTI

Mission and Vision

Mission

To drive on behalf of our members business, policy, research and innovation development in the IoT & Edge Computing and other converging technologies across the Digital Value Chain to support digitization in Europe, and competitiveness of Europe.

Vision

Together we aim to lead, promote, bridge and collaborate in IoT & Edge Computing and other converging technologies research and innovation, standardisation and ecosystem building providing IoT deployment for European businesses creating benefits for European society. We co-operate with other global regions to ensure removal of barriers to development of the IoT & Edge Computing market, while preserving the European values, including privacy and consumer protection.

Our community

185
Members

806
Contributors

9
Groups

7
Focus Groups

7
Task Forces

42
Corporates

63
SMEs

57
Research/Academia

21
Associations

2
Public Authorities

AIOTI

How we work

Horizontal WG

- Research & Innovation
  - Innovation Ecosystems
  - SCoDIHNet
- Standardisation
  - Semantic Interoperability
  - Landscape, Gaps, Comp Continuum, IoT and relation to 5G
  - High-Level Architectures
  - Security & Privacy
- Testbeds
- Policy

Vertical WG

- Agriculture
- Energy
- Buildings & Communities
- Health
- Manufacturing
- Mobility

Task Force

- Digital for Climate
- Early Innovation Champions
- Web3 Accelerator

AIOTI

Our Priorities in 2023

Research and Funding

- AIOTI SRIA
- Smart Networks
- Consortia building
- Project participation
- Open Call
- Project result dissemination and events

Policy and Standardisation

- AI, Data, Cybersecurity
- Green Deal
- Testbeds promotion
- Standardisation
  - European HLF
  - ICT Rolling Plan

Business Forum

- Monthly sessions
- Business sharing and matchmaking
- Support in projects

Events

- Signature Event
- Bi-Monthly Events
- Topical Workshops:
  - SRIA
  - Buildings and Communities
  - Health
  - Energy
  - Agriculture ...

Special Projects

- Web3 Accelerator
- DLT PET Testing

AIOTI

Our Deliverables (I)

Research & Innovation

Strategic Research and Innovation agenda

Strategic Foresight Through Digital Leadership: IoT and Edge Computing Convergence

HE Interim Evaluation

(Immersive technologies, digital twins and edge/AI)

White Paper Mission and Activities of IoT Digital Innovation Hubs Network

Vision on IoT Innovation Ecosystems

Replicability and Scalability Assessment Tool

(Diversity and circularity as enabler for innovation)

(DIH Service Platform)

Policy

AI Act and AI Liability

Network and Information Security Directive 2

Chips Act

Data Act

Data Governance Act

Cybersecurity Resilience Act

EU Standardisation Strategy

Standardisation

IoT & Edge Landscape Report

Gap Analysis Report

IoT Impact Beyond 5G Report

Computing Continuum Report

Ontology Landscape Report

Guidance on integration of IoT/Edge in Data Spaces

Landscape of EU funded projects

(High Level Architectures and Digital Twins)

(Report on continuum)

Testbeds

IoT/Edge Testbeds Catalogue

IoT/Edge Testbed Methodology

Report on DLT-IoT-AI Technological Convergence

(DLT PET testing)

(DLT Testbeds & Regulatory Sandbox)

Digital for Climate

Sustainability Product Initiative

Renewable Energy Directive III

Strategic Foresight Report

Green Deal Vision

Carbon removal certification

Methodology for carbon footprint measurement and reduction (Collaboration with ETSI/ITU-T SG5)

EGDC contribution

Our Deliverables (II)

Agriculture

Role of IoT in addressing the agroecological focus of the Green Deal

Role of IoT in addressing biodiversity and environmental monitoring

Buildings & Communities

Energy Efficiency Directive recast

Renewable Energy Directive recast

Revision of Energy Performance of Buildings Directive

(IoT value for building and infrastructure)

IoT and Crisis Preparedness

Online Catalogue of Solutions

IoT improving Healthy Urban Living

Energy

Open Energy Marketplaces Evolution - Beyond Enabling Technologies

Digitalising Energy System Action Plan

Energy Flexibility Solutions

Electricity Market Design

(Edge driven Digital Twins in distributed energy systems)

EC Smart Grids Expert Group

Health

AI for better health

(Health Data and Data Spaces)

Mobility

Electric vehicles (EV) and electric vehicle charging User Cases driven approach

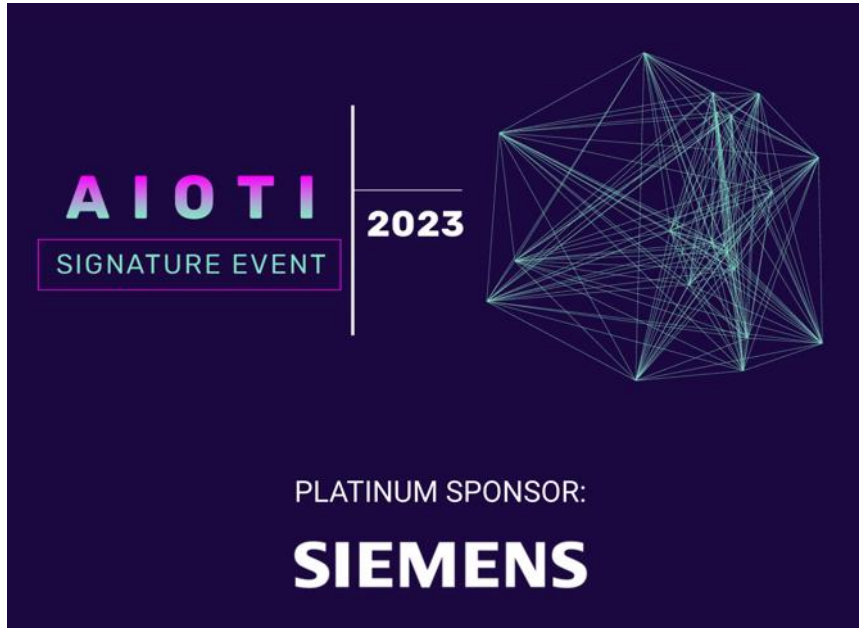
(White Paper on future mobility)

Manufacturing

Business Impact of IoT in Manufacturing Industries

AIOTI

Events: 48 organised, supported, speaking



Bi-Monthly

Business Forum

IOTWeek

PRIVACY SYMPOSIUM
Conference in Venice, Italy
17-21 April 2023

IOT TECH EXPO
EUROPE

its EUROPEAN CONGRESS

GSMA MOBILE WORLD CONGRESS

IOT SOLUTIONS WORLD CONGRESS

SMARTCITY EXPO WORLD CONGRESS

IEEE World Forum on Internet of Things

Digital Around the World