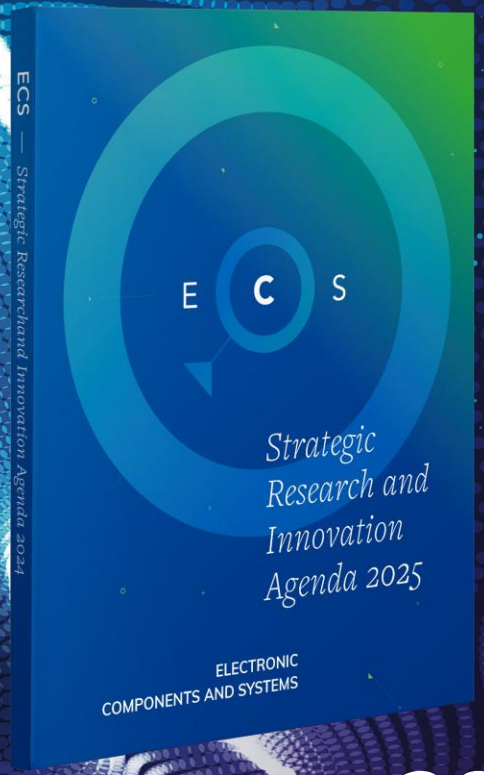


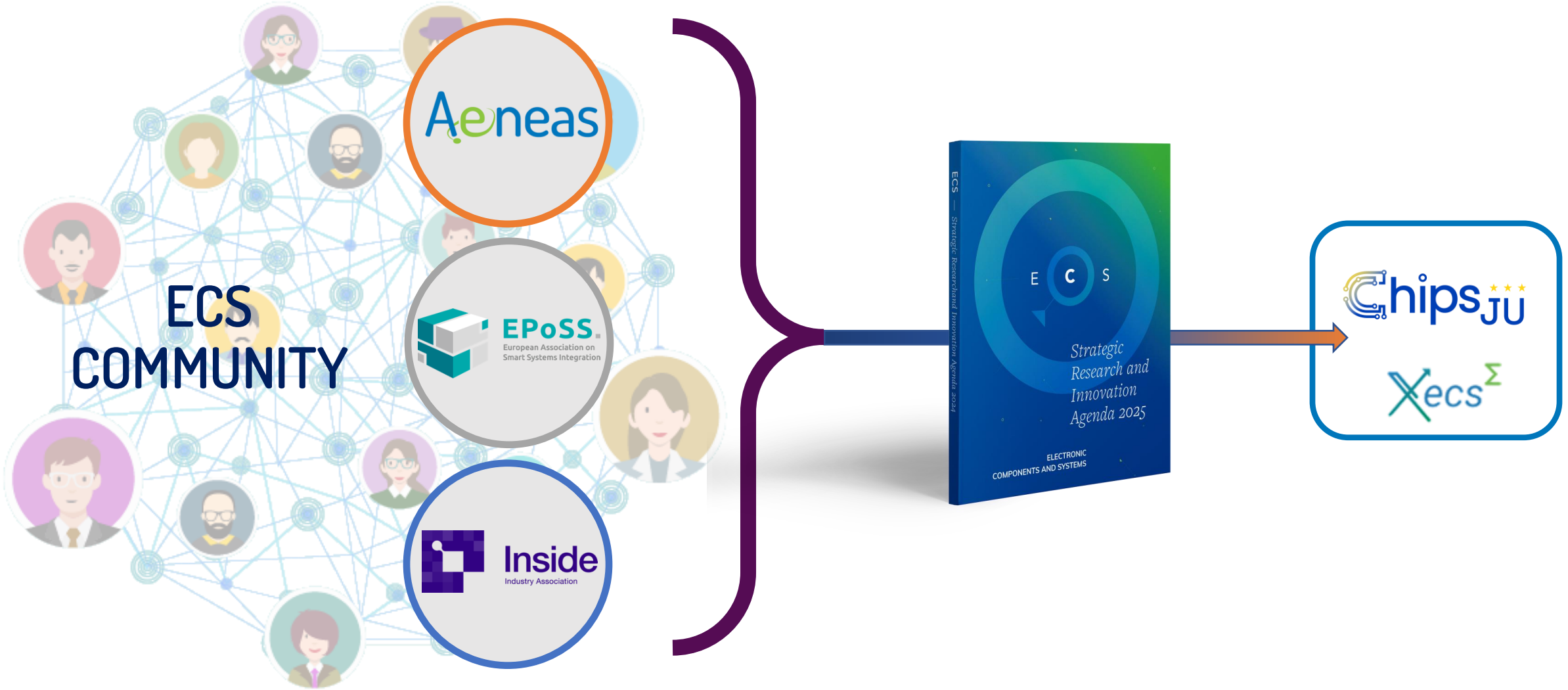
ECS 2024 GHENT BELGIUM 5-6 December

2025 ECS SRIA – Key trends and changes

Patrick Cogez, AENEAS Technical Director, ECS SRIA Chair

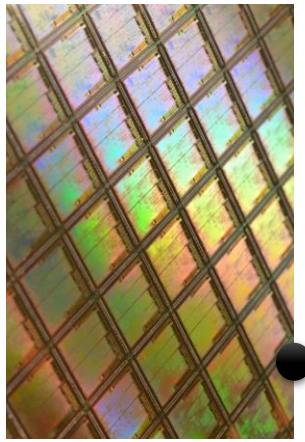
December 6, 2024

The 2025 ECS SRIA 2025 - Why ?
Align and coordinate research policies across Europe

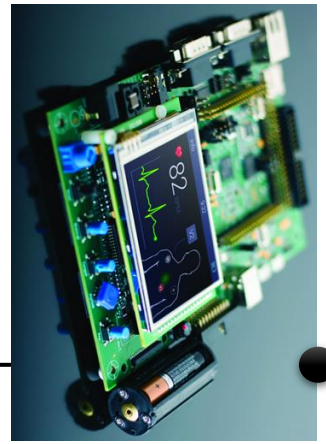


The 2025 ECS SRIA – What ?

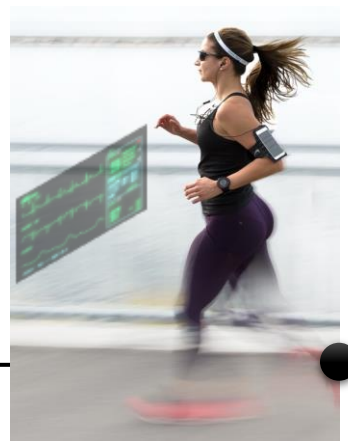
- Presenting **research topics** to be investigated over next 15 years
- To foster and accelerate our European **digital transformation** reflecting European values
- Covering the **whole value chain of Electronic Components & Systems (ECS)**



Materials, processes, semiconductors, micro & nano electronic components, …



Smart sensors, integrated devices, edge AI, embedded SW, …



Systems and applications, value creation, societal goals, …

ECS engineering tools

The 2025 ECS SRIA – Who ?

Patrick Cogez
AENEAS
Chairman

Paolo Azzoni
INSIDE IA
Co-chairman

Matthias Küntzel
EPoSS
Co-chairman

Core Team

- Arco Krijgsman - ASML
- Christophe Wyon - CEA
- Jerker Delsing - Lulea University of Technology
- Jürgen Niehaus - SafeTRANS
- Patrick Pype - NXP
- Sven Rzepka - Fraunhofer
- Wolfgang Dettmann - Infineon Technologies AG

More than 280 European experts

- Interdisciplinary
- Across the whole ECS value chain
- Representing industry, RTO and academia
- 24 countries

Open consultation

INDUSTRY ASSOCIATIONS RELEASE THE DRAFT VERSION OF THE ECS SRIA FOR 2025

We are pleased to announce the draft of the eighth edition of the Electronic Components and Systems (ECS) Strategic Research and Innovation Agenda (ECS-SRIA). This edition, coordinated by AENEAS, EPoSS, and INSIDE, reflects the latest trends in the ECS industry and supports the European Chips Act that came into effect on 21 September 2023. It builds on the ECS SRIA 2024, linking research focus areas to the Design Platform and Pilot Lines to be implemented by the Chips JU.

We welcome contributions from the community; please submit your feedback by email **before October 24th** to contact@aeneas-eposs-inside.eu.

The full draft edition of ECS SRIA 2025 is now available below!

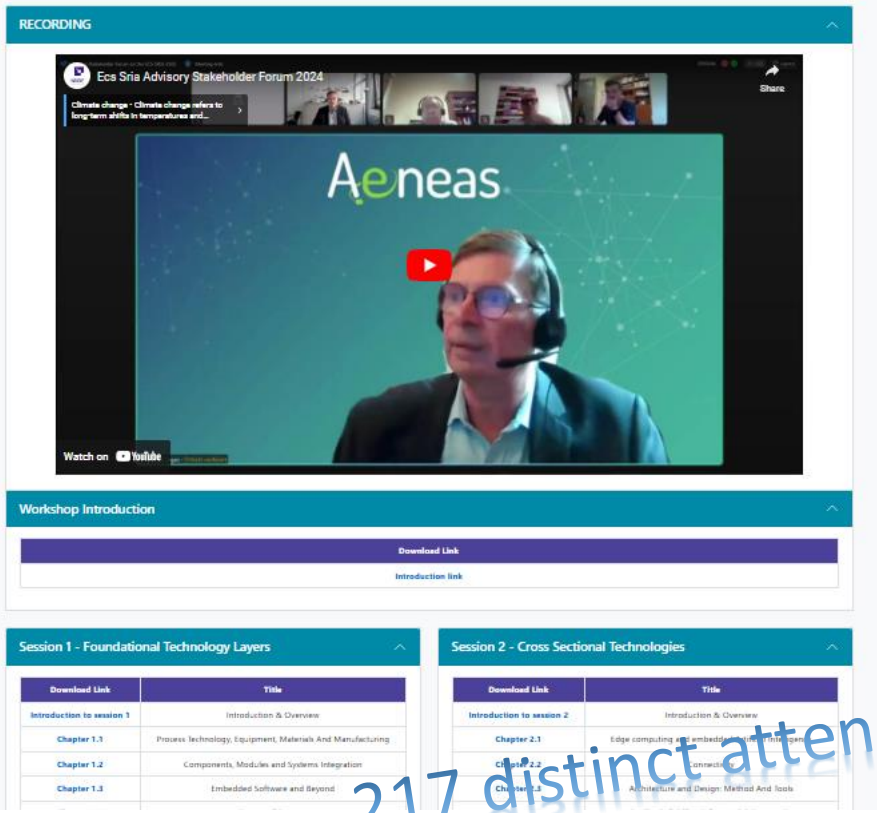
In addition, the 3 Industry Associations AENEAS, EPoSS and INSIDE organised on October 17th an online Advisory Stakeholders Forum. You can find the recording of that event, as well as the presentations at https://ecssria.eu/2025_consultation. Answers to questions collected during that event will be included soon.

Download Link	Chapter
Chapter 0 (pdf)	Chapter 0: Introduction & Overview
Chapter 1.1 (pdf)	Chapter 1.1: Process Technology, Equipment, Materials And Manufacturing
Chapter 1.2 (pdf)	Chapter 1.2: Components, Modules and Systems Integration
Chapter 1.3 (pdf)	Chapter 1.3: Embedded Software and Beyond
Chapter 1.4 (pdf)	Chapter 1.4: System of Systems
Chapter 2.1 (pdf)	Chapter 2.1: Edge computing and embedded Artificial Intelligence
Chapter 2.2 (pdf)	Chapter 2.2: Connectivity

Written procedure, Oct 11th – 24th

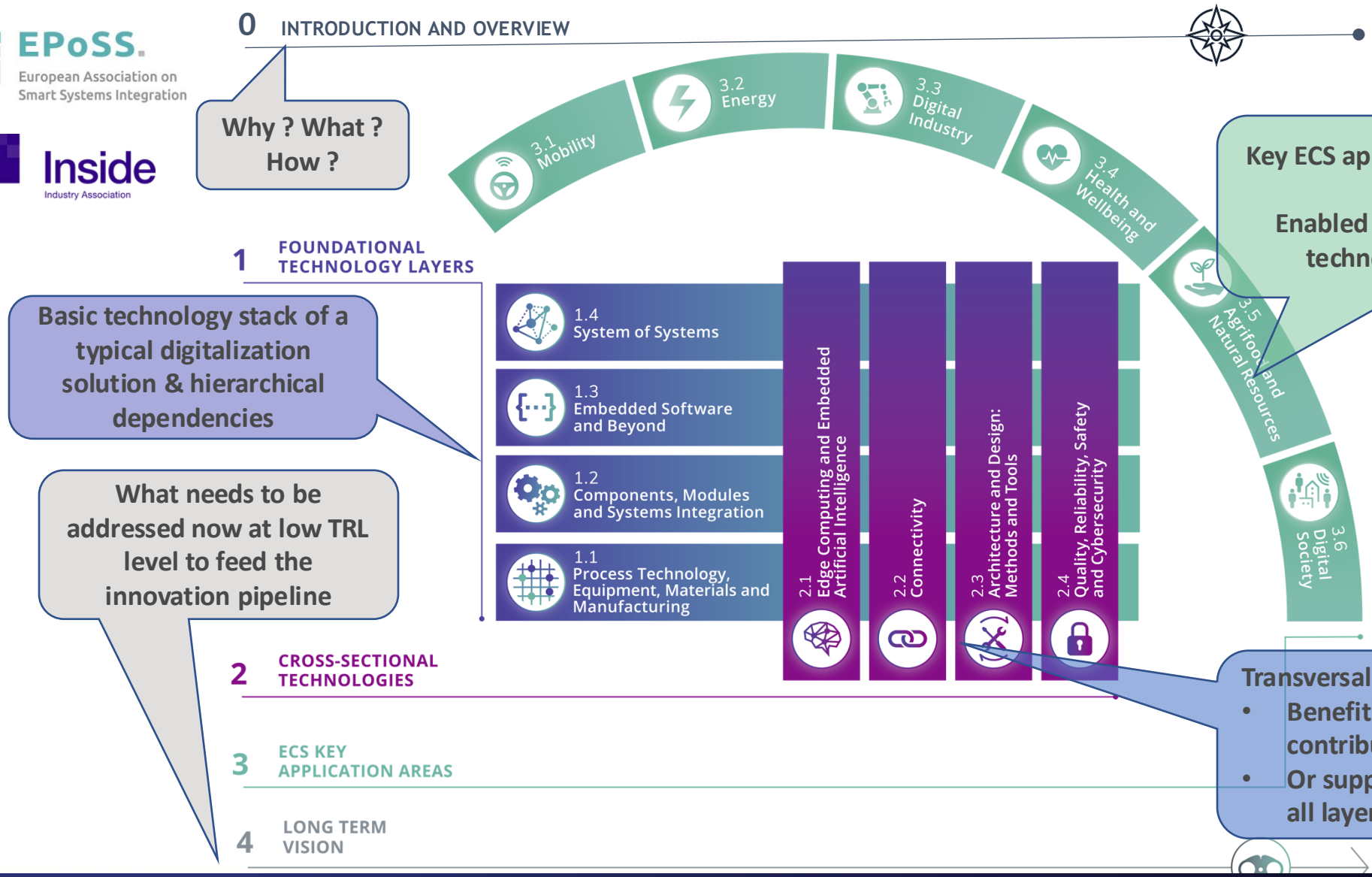
Advisory Stakeholder Forum on the ECS-SRIA 2025 & Public Consultation Results

The 3 Industry Associations AENEAS, EPoSS, and INSIDE organized an online Advisory Stakeholder Forum on October 17th. You can find on this page the recording, the presentations and the answers to the questions collected during that event.



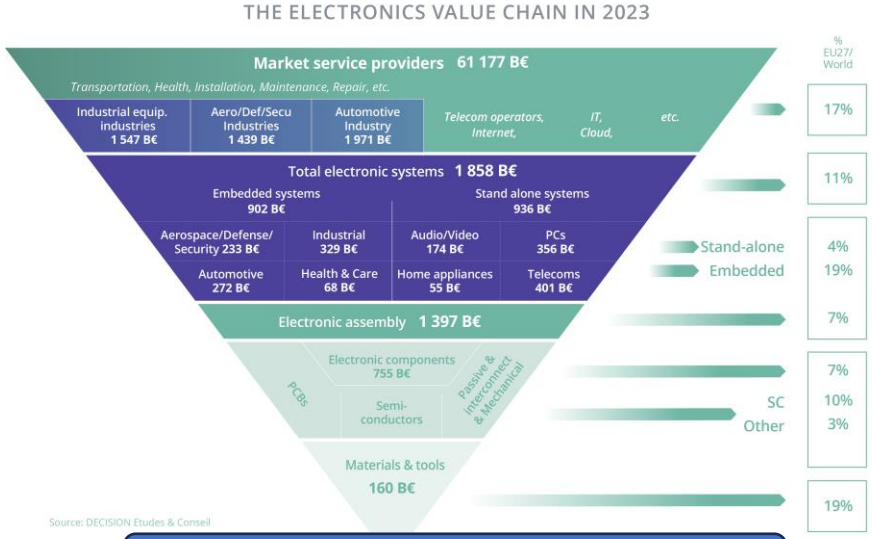
217 distinct attendees

ECS-SRIA structure



Ch. 0 - Restructured in Why / What / How

- Why ECS matter



Strategic importance for the EU

Addressing societal challenges

- What? SRIA content, including new and/or expanded cross-cutting themes

Chiplets

Open Source Hardware

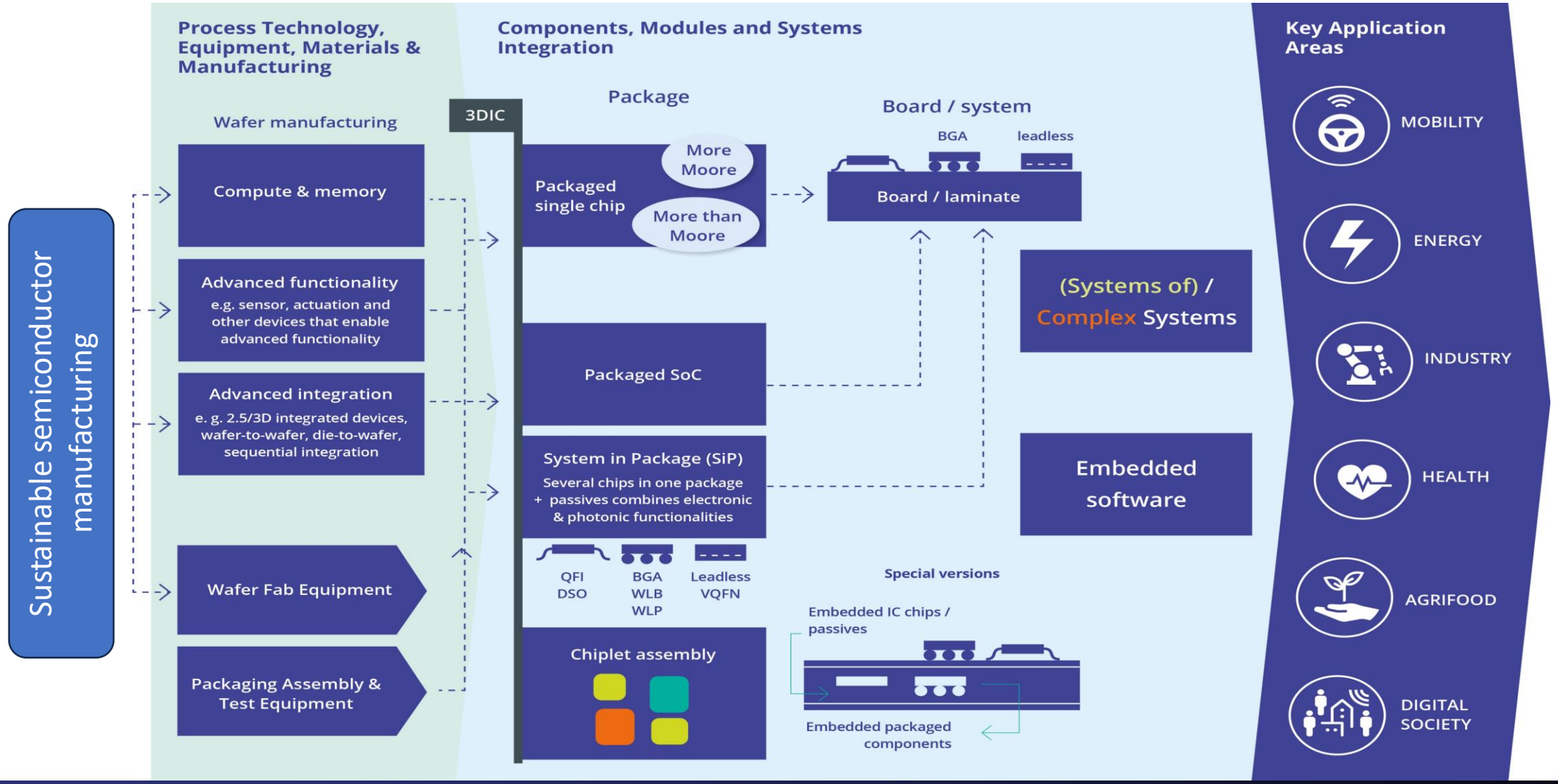
AI

Silicon Photonics

Quantum Technologies

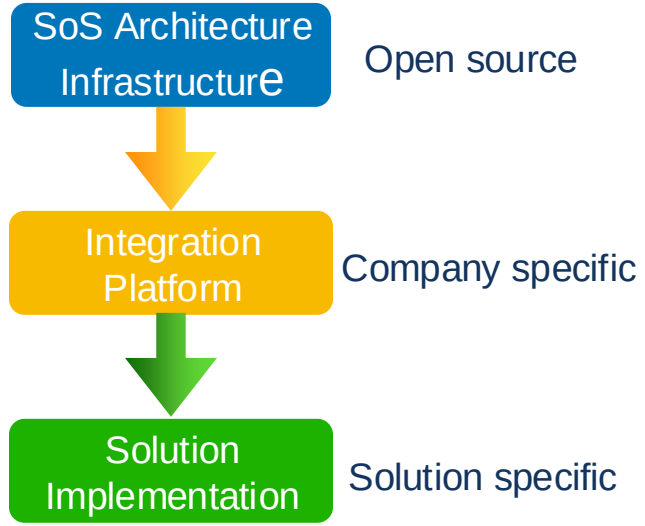
- How to make it happen
  - Link with Pilot Lines and the Design Platform

Ch. 1.1 - Process Technology, Equipment, Materials and Manufacturing & Ch. 1.2 – Components, Modules and Systems Integration



Ch. 1.3 – Embedded Software and Beyond
& Ch. 1.4 – System of Systems

- Scale and complexity of System and SoS integration, monitoring and management over its life cycle
  - Including sustainability dimension
- Importance of engineering efficiency
  - Embedded software
    - New programming languages (Rust)
    - Virtualisation and virtual prototypes
  - System of Systems
    - Model based engineering
    - Low code technologies
    - AI supported engineering tools
    - Automation of test, verification and validation processes



Key trends in embedded Software

- Quantum Computing
- Computing accelerators
- Artificial Intelligence

SoS infrastructure concept

- Enabling company and application specific platforms
- Enabling efficient engineering of solutions

Ch. 2.1 – Edge Computing and Embedded Artificial Intelligence

This chapter focuses on **computing components**, and more specifically on **embedded architectures, edge computing devices and systems using artificial intelligence at the edge**, including:

- Processors (CPU, MPU) with high energy efficiency,
- Accelerators (for AI and for other tasks, such as security)
- GPU, NPU (Neural processing unit), DPU (Data processing Unit, e.g. logging and collecting information for automotive and other systems), Other accelerators xPU (FPU, IPU, TPU, XPU, …)
- Memories and associated controllers, specialized for low power and/or for processing data locally
- Power management systems and techniques

Ch. 2.1 - Key trends

More and more convergence between edge computing and embedded (generative) AI, but ***still a lot of edge will be without AI***

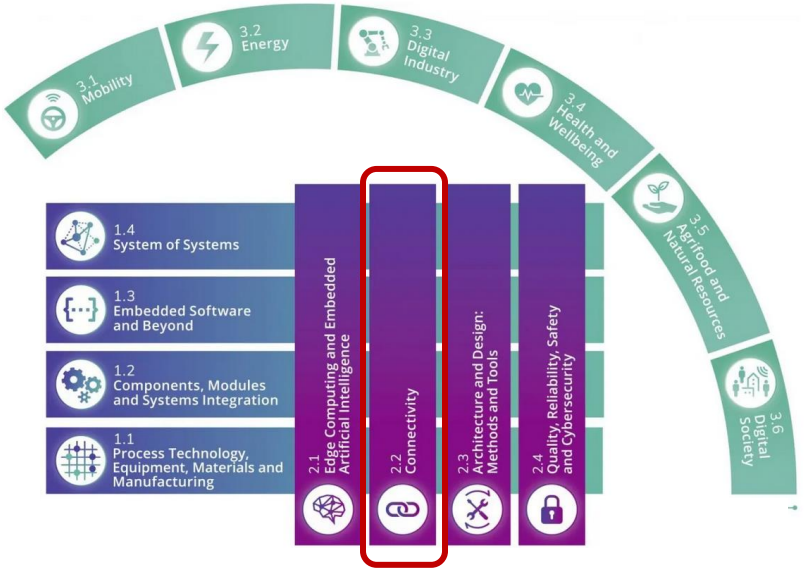
Emergence of ***Gen-AI at the edge***

<u>New Recommendations:</u>

- A system becomes an ***orchestration of federated services, distributed or centralized*** (Software Defined X).
- Disaggregation of complex SoC into chiplet + interposers, but still no ecosystem of interoperable chiplets and overall architecture.
- ***Memory cost is crucial for generative AI at the edge***. New innovations required to avoid to waste RAM
- Emergence of (very) cheap Chinese Risc-V microcontrollers
- Further ***reducing standby power*** and fast on operation (stop and go for chips?)
- Still research required for ***new computing paradigms*** (neuromorphic, ***using physics to make computation*** – analog computing -, etc) and their ***validation*** in product ready solutions.

Ch. 2.2 – Connectivity

	LAYER	DATA UNIT	FUNTION
HOST LAYERS	7. Application		Network process to application.
	6. Presentation	Data	Data representation, encryption and decryption, convert machine-dependent data to machine-independent data.
	5. Session		Interhost comunication, managing sessions between applications.
MEDIA LAYERS	4. Transport	Segments	Reliable delivery of segments between points on a network.
	3. Network	Packet/Datagram	Addressing, routing and (not necessarily reliable) delivery of datagrams between points on a network.
	2. Data link	Bit/Frame	A reliable direct point-to-point data connection.
	1. Physical	Bit	A (not necessarily reliable) direct point-to-point data connection.



- Updates to the frequency scope of wireless connectivity
  - Downplaying significantly higher frequencies
- Support for efficient engineering of application solution connectivity
- Support to SoS integration and interoperability

Ch. 2.3 – Architecture and Design: Methods and Tools & Ch. 2.4 – Quality, Reliability, Safety and Cybersecurity

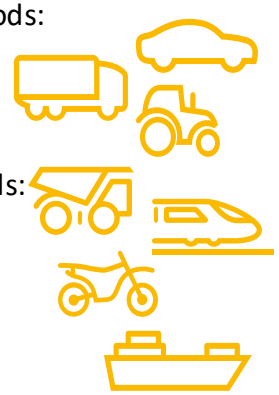
- Architecture and Design
  - Ever increasing functionality and complexity of ECS based systems comprising heterogeneous subsystems and components
  - Agile continuous development processes by using data collected during run-time (and production, maintenance,…)
  - AI a curse and a blessing
    - Increased use of AI in components and subsystems, with corresponding challenges for quality and safety assurance
    - Advanced productivity and cost-effectiveness by using AI in Development and Test
  - Need for sustainable design for sustainability

- Quality, Reliability, Safety and Cybersecurity
  - A degraded behaviour in any of these 4 dimensions or an incorrect integration among them, would affect vital properties of ECS and could cause serious damage
  - Rethink many “traditional” approaches and expected performances towards safety and security, exploiting AI and ML (machine learning)
  - New text on
    - ➢ Chiplet-based approach
    - ➢ AI innovation & safety and cybersecurity issues

Ch. 3.1 – Mobility

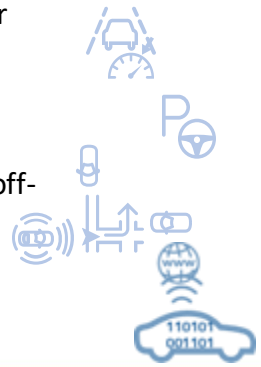
Mobility modes considered in chapter:

- **Automotive mobility** for passengers and goods: passenger cars, two/three wheelers, trucks
- **Maritime mobility**: ships
- **Aerospace mobility** for passengers and goods: airplanes, helicopters, drones
- **Mobility on rails**: trains
- **Mobility in smart farming and off-road machinery**: smart farming machinery, smart mining, …



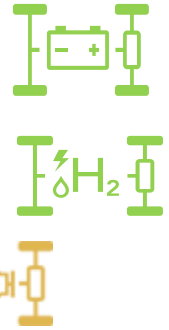
Automation level

- Vehicles supported by **ADAS** (advanced driver assistance systems)
- **Automated** and autonomous vehicles (AD)
- **Software defined vehicles** (in-vehicle stack, off-vehicle cloud stack) (Infotainment, cockpit, ADAS/AD, Body & chassis control)



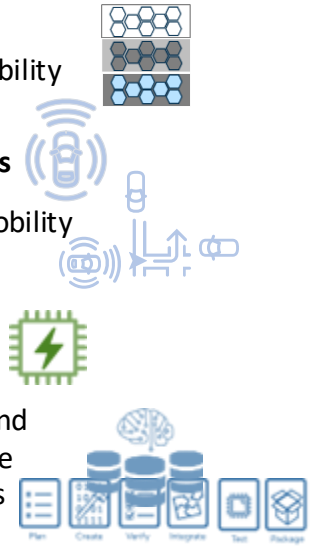
Energy type

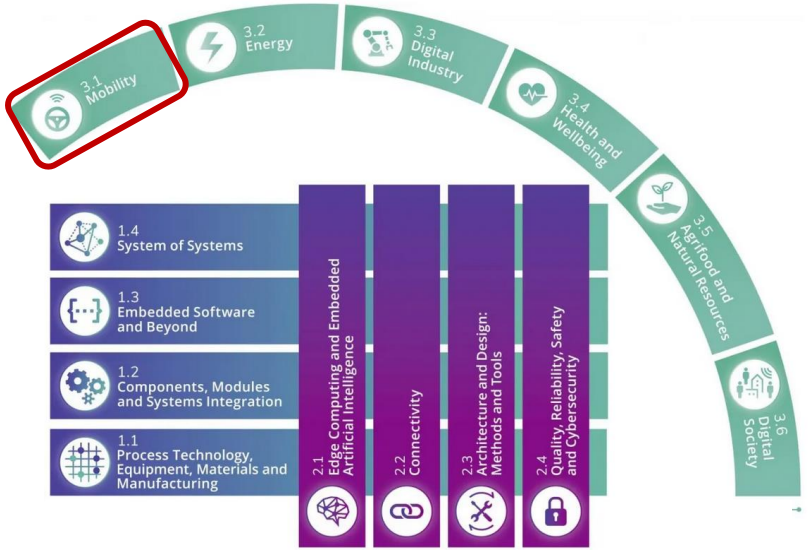
- **Battery electric** vehicles (trains, passenger cars, trucks, off-road machinery, airplanes)
- **Hydrogen** powered vehicles (trains, passenger cars, trucks, off-road machinery, airplanes)
- **Hybrid** vehicles



Areas for ECS

- **HPC HW** and **SW** for **Stacks** in mobility (e.g. SDV)
- **HW** and **SW** for **ADAS/AD sensors**
- **Automated driving** for various mobility modes
- **Fast** and **energy efficient** power converter chips (**SiC, GaN**)
- **AI** supported **engineering tools** and **toolchains** to significantly increase development efficiency in DevOps processes





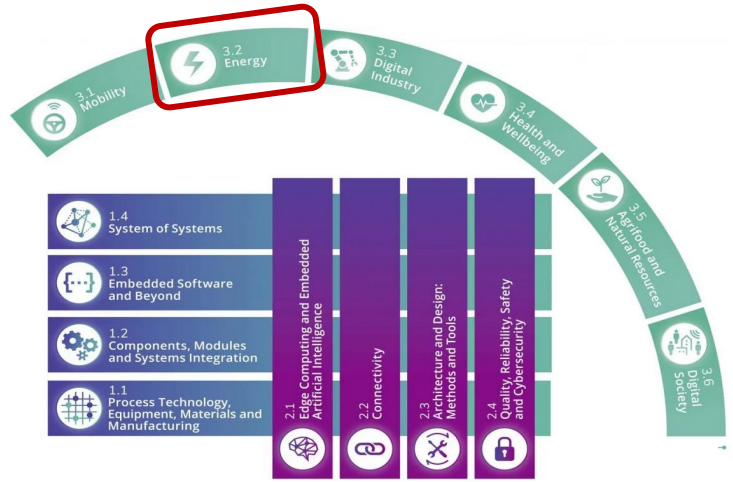
Ch 3.1 - Major challenges in ECS for Mobility

- **Major challenge 1:** SDV hardware platforms: Modular, scalable, flexible, safe & secure
- **Major challenge 2**: SW Platforms for SDV of the future; Modular, scalable, re-usable, flexible, safe & secure, supporting edge2cloud applications
- **Major challenge 3:** Climate and energy neutral mobility: CO_2-neutral mobility
- **Major challenge 4:** Digitalisation: Affordable, automated, and connected mobility for passengers and freight
- **Major challenge 5:** Edge2cloud mobility applications: Added end-user value by cloud2cloud features
- **Major challenge 6:** Validation: Methods and tools using AI for validation and certification of safety, security, and comfort in mobility

These 2 challenges were combined in one topic in SRIA 2024

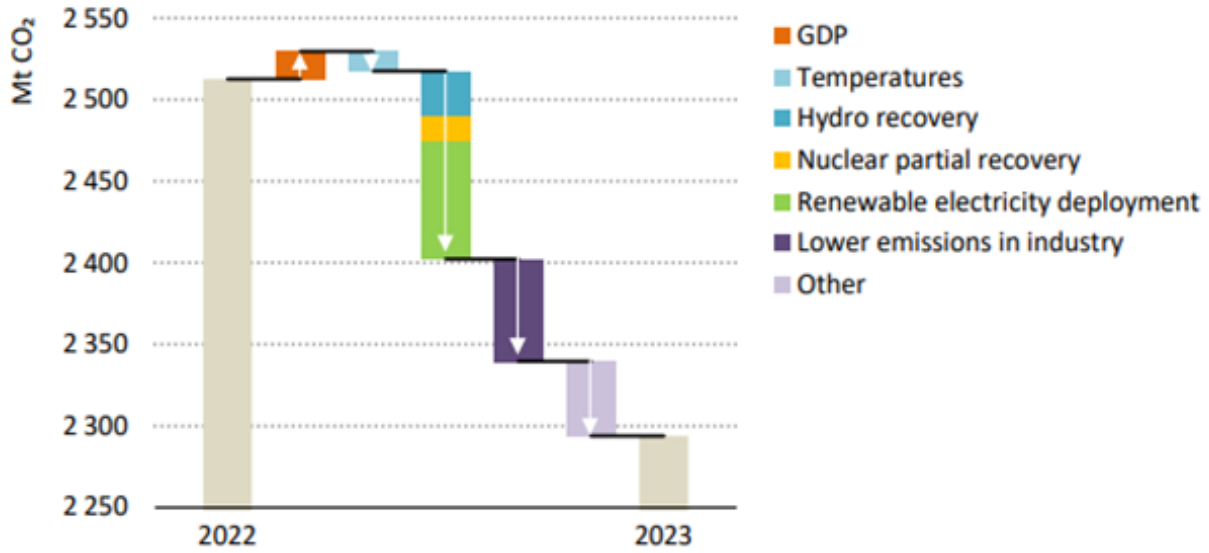
- **Multimodal mobility** → **moved** to chapter "**Digital Society**" in SRIA 2025

Ch. 3.2 – Energy



Electronic components and systems (ECS) are key to future energy systems being optimised in both design and operation, for high efficiency, substitution to zero emission technologies, low CO2-emissions, cost, and security of supply.

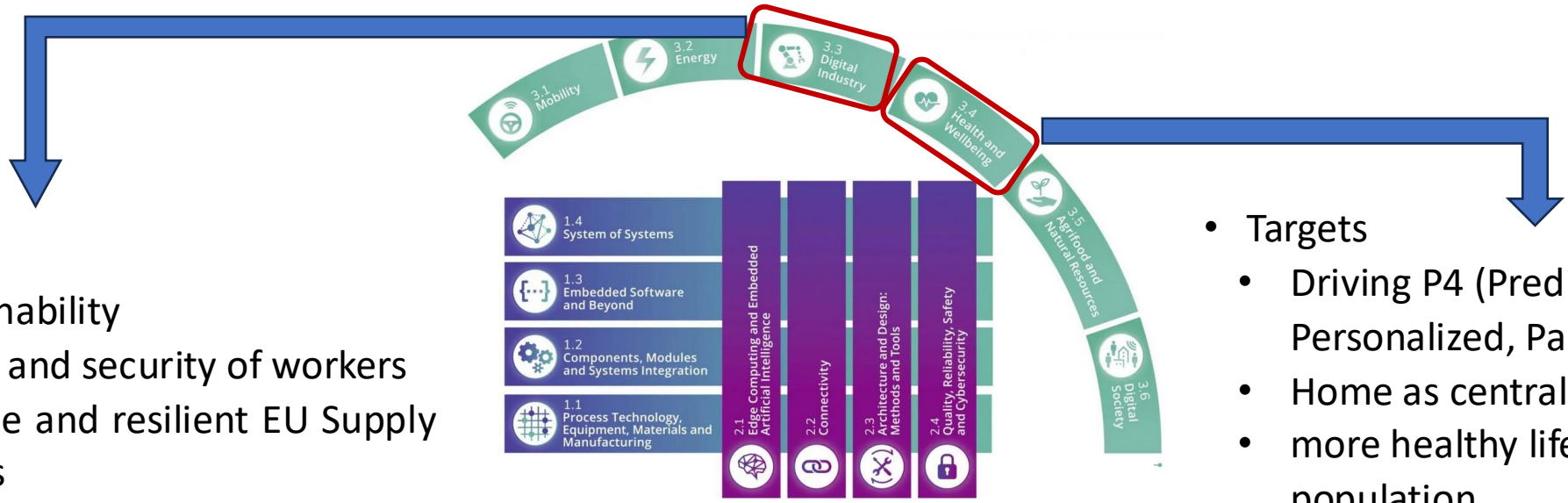
Figure 9: Change in total CO_2 emissions from combustion in the European Union by driver, 2022-2023



IEA (2024), CO2 Emissions in 2023, IEA, Paris https://www.iea.org/reports/co2-emissions-in-2023, Licence: CC BY 4.0

Ch. 3.3 - Digital industry & Ch. 3.4 – Health and Wellbeing

Impact of introduction of cutting-edge digital technologies



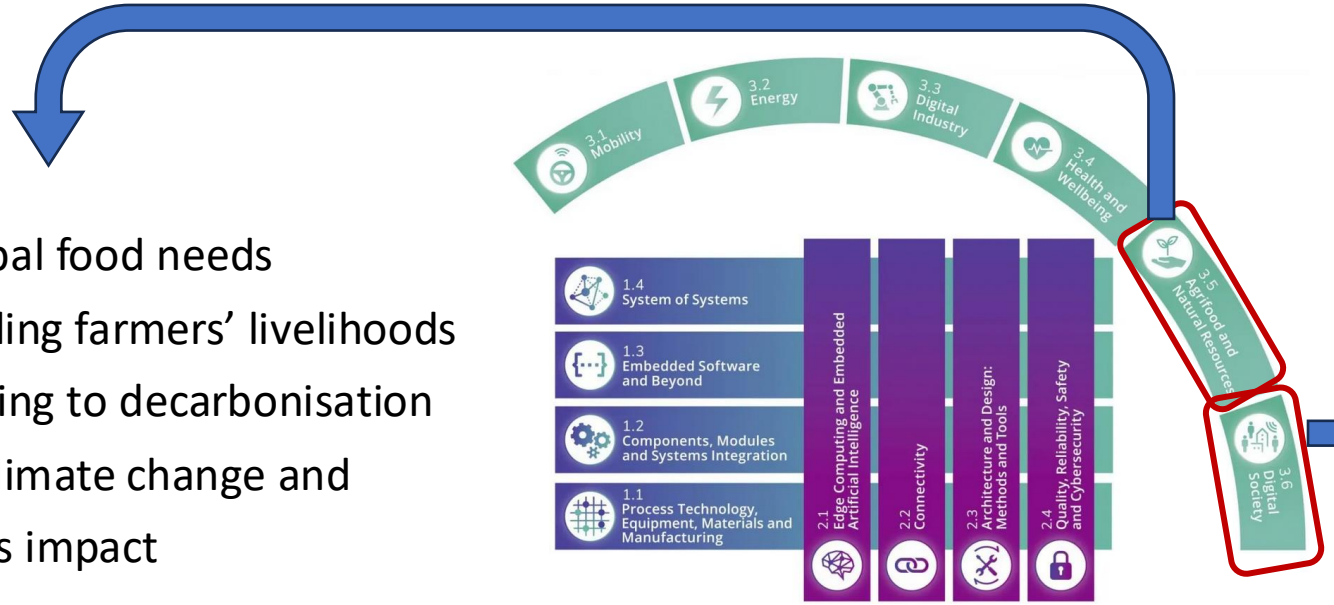
- Targets
  - Sustainability
  - Safety and security of workers
  - Flexible and resilient EU Supply Chains

- Targets
  - Driving P4 (Predictive, Preventive, Personalized, Participatory) medicine
  - Home as central location of care
  - more healthy life years for an ageing population

- Key ECS research threads
  - Trustworthy, responsible AI, XR and robotics
  - Exploitation of next generation HW architectures and new chip design (e.g. RISC-V, PIC)

- Key trends
  - MedTech and Pharma moving towards comprehensive healthcare platforms using smart devices, remote monitoring, data analytics, and AI
  - Blurring the boundaries between Pharma, MedTech, and Chips companies, fostering cross-industry collaboration

Ch. 3.5 – Agrifood and natural resources & Ch. 3.6 – Digital Society



- Targets
  - Meet global food needs
  - Safeguarding farmers' livelihoods
  - Contributing to decarbonisation
  - Slowing climate change and limiting its impact

- Accelerate the deployment of smart systems in agriculture, food production, natural resources and ecosystems
  - Increase electrification and use of agrivoltaics solutions
  - Increase the development of agroforestry
  - Introduce IoT solutions based on AI
  - Provide education and agriculture-based services
  - Reducing food loss and waste

- Target
  - Foster an inclusive, sustainable, and resilient society

- Trends
  - Digitisation
  - Use of AI-based tools (such as ChatGPT, …)
  - Increasing need to protect against fake video and audio
  - Increasing importance of cybersecurity

Ch. 4 - Long Term Vision Chapter

- Identify the research subjects that need to be addressed now at low TRL in order to feed the pipeline of innovation of the European ECS ecosystem in the longer term

- Major topics:
  - Sustainability
    - Energy, power, water in chemical processes
    - Recyclable devices
    - Environmental aspects
    - Innovative materials
  - Quantum technologies and enabling ECS
  - Distributed intelligence (includes "Distributed AI", "Embedded AI", etc.)
  - Connectivity (Information transfer, connectivity for system integration, security issues)
  - Non-conventional computing and storage devices
  - Advanced packaging and heterogeneous integration technologies and tools
  - Autonomous systems
  - Resilient (robotic) applications
  - Supply chain issues

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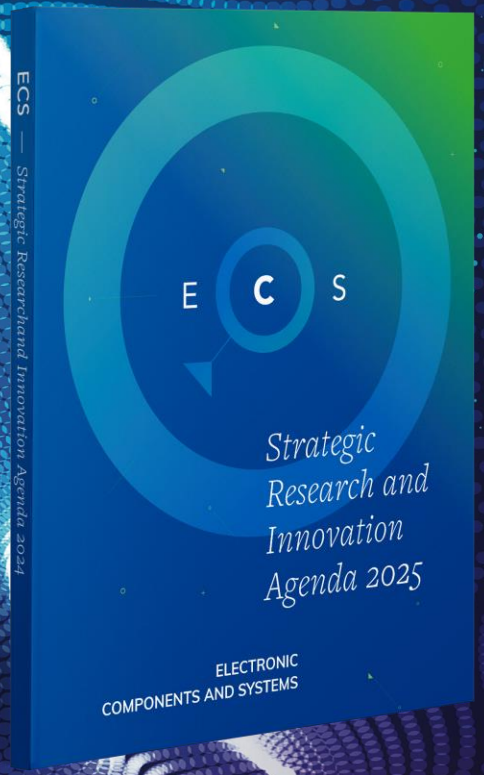

Chips JU

ECS 2024 GHENT BELGIUM

5-6 December

Thank you !