Chapter 1.1
PROCESS TECHNOLOGY, EQUIPMENT, MATERIALS AND MANUFACTURING

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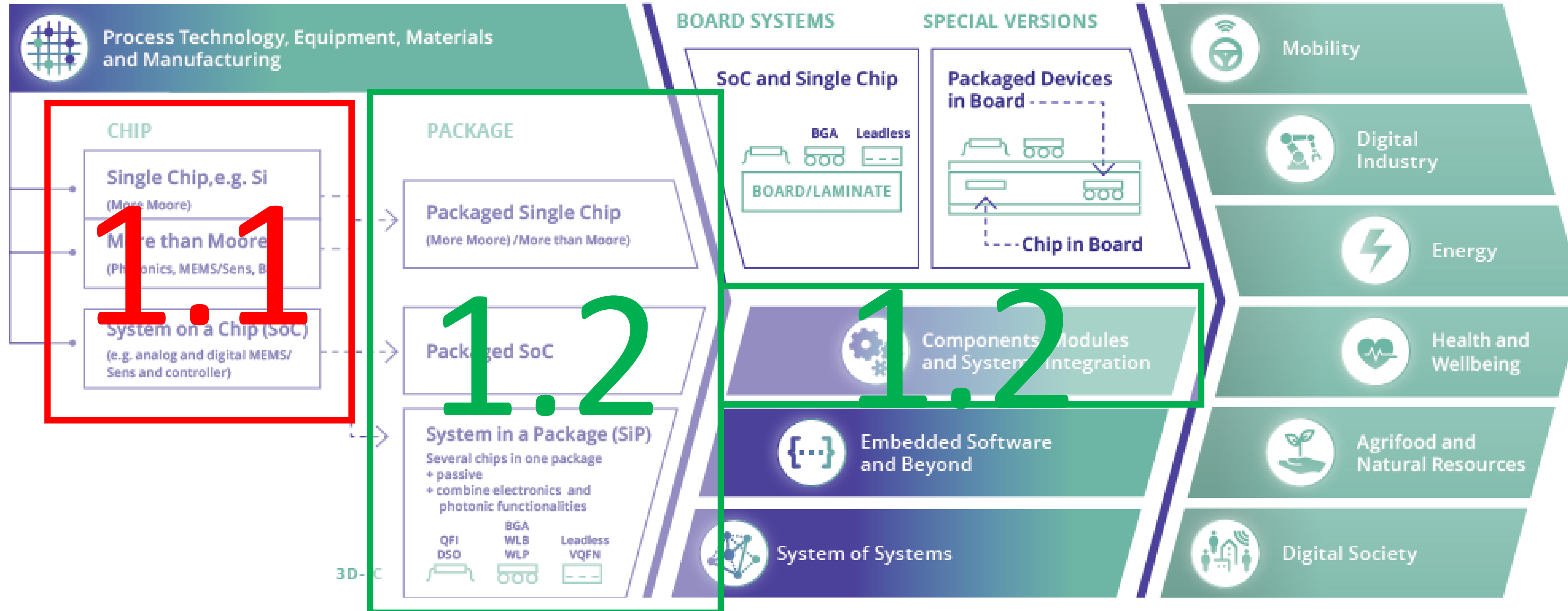
Strategic Research and Innovation Agenda 2025

Aeneas

Scope



Trends & Major challenges (1)

- **Major Challenge 1:** Advanced computing, in-memory, neuromorphic, photonic and quantum computing concepts.

Materials and substrates, process modules and integration technology for novel devices and circuits for advanced computing, memory and in-memory computing concepts based on nano-electronic, photonic, quantum or other technology.

- **Major Challenge 2:** Novel sensor , actuation and other devices that enable advanced functionality.

Materials and substrates, process modules and wafer level integration technology for novel devices and circuits that enable advanced functionality: sensing including quantum sensing, actuating, power conversion, connectivity, etc.

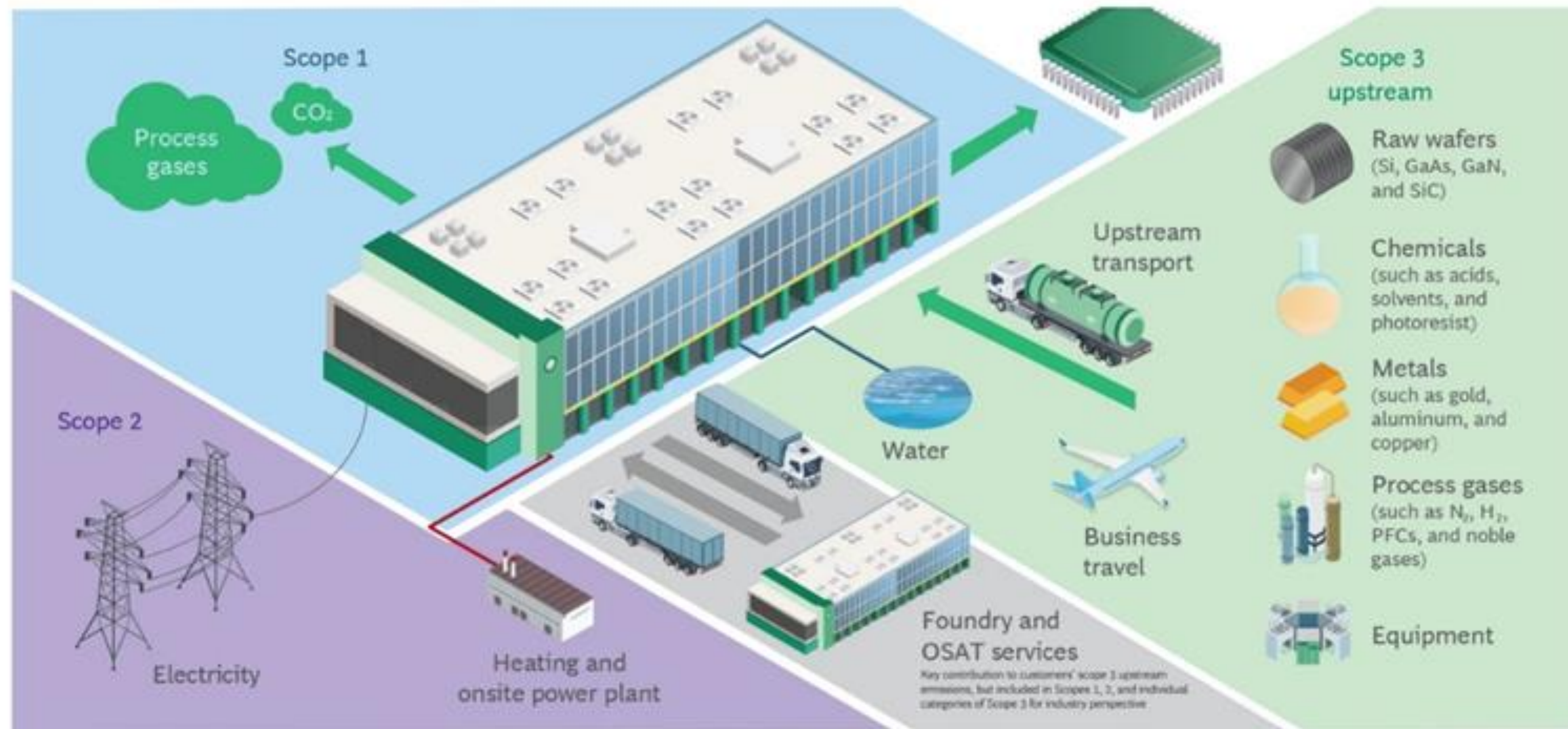
- **Major Challenge 3:** Advanced integration solutions.

Advanced integration including 2.5/3D integrated devices at wafer level, wafer-to-wafer (W2W) or material on wafer (sequential integration) or dies bonded/attached to a wafer (D2W), etc.

Trends & Major challenges (2)

- **Major Challenge 4:** Advanced wafer fab equipment and manufacturing solutions.
  Equipment and manufacturing technologies for processing wafers in fabs from leading edge nodes to differentiated technologies and for advanced functionality devices, including new materials or unconventional geometry and heterogeneous integration technology options.
- **Major Challenge 5:** Advanced packaging, assembly & test equipment solutions
  Equipment solutions to enable assembly and testing of a wide range of IC's from logic and memory to advanced 2.5/3D integrated devices
- **Major Challenge 6:** Sustainable semiconductor manufacturing
  Solutions to reduce Greenhouse gas emission, water & gas consumption and use of hazardous materials.

Focus area: Sustainable semiconductor manufacturing



Source: BCG analysis.

Note: Si = silicon; GaAs = gallium arsenide; GaN = gallium nitride; SiC = silicon carbide; N_2 = nitrogen; H_2 = hydrogen; PFCs = perfluorinated compounds; OSAT = outsourced semiconductor assembly and test.