Fraunhofer Institute for Reliability and Microintegration IZM

Electronic Packaging Days 2025

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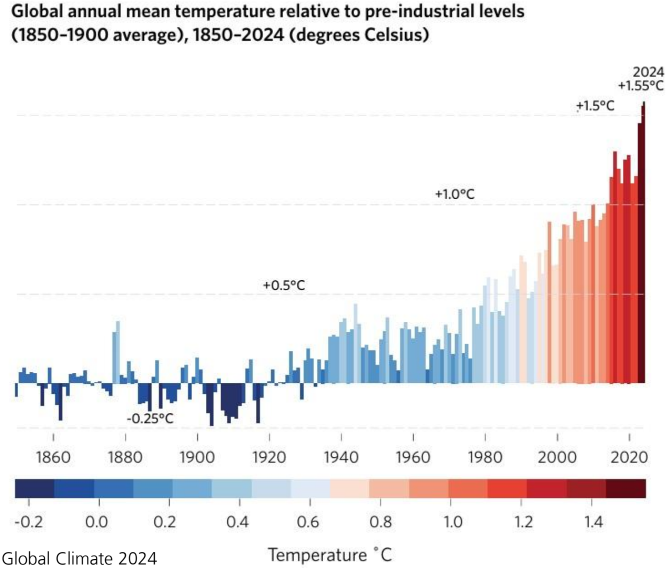
Why the IT Giants Are on the Quest for Enhanced Environmental Transparency

Intro

Climate change is real…

…and IT giants trust in science.



Source: World Meteorological Organization State of the Global Climate 2024

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The 1.5° C Pathway

Pledges by IT Giants

Company	Key Climate Pledge	Target Date	Carbon Offsetting/Removal Limit (for Net-Zero Goal)	Additional Commitments
Apple	**Carbon Neutral** across its entire value chain (full product life cycle).	**2030**	Emissions reduction of **75%** from a 2015 baseline; the **remaining ≤25%** must be neutralized using high-quality **carbon removal** projects (e.g., Restore Fund).	100% renewable electricity for corporate operations (achieved 2020) and a target for the supply chain to transition to 100% renewable energy by 2030.
Microsoft	**Carbon Negative** (for all Scope 1, 2, and 3 emissions).	**2030**	Emissions reduction of **more than half** by 2030; the **remaining ≤50%** must be neutralized using high-quality **carbon removal** (CDR) projects.	Remove all historical emissions since founding by 2050.
Google	**Net-Zero Emissions** (across all operations and value chain).	**2030**	Aims to reduce combined Scope 1-3 absolute emissions by **50%** before 2030; the **remaining ≤50%** will be neutralized with nature-based and technology-based carbon removal solutions.	Achieve **24/7 Carbon-Free Energy (CFE)** for all data centers and campuses by 2030.
Amazon (AWS)	**Net-Zero Carbon** across its entire business	**2040**	The corporate commitment is to eliminate emissions in the value chain, and then neutralize **any remaining** emissions with offsets. **AWS-specific goals** often prioritize absolute elimination and reduction in infrastructure. No specific percentage cap on offsets for the final 2040 residual emissions is publicly quantified for the overall goal.	**AWS Infrastructure** aims to be powered by **100% renewable energy** (achieved 2023).
Meta	**Net-Zero Emissions** across its entire value chain.	**2030**	Primarily focuses on emissions reduction. **Residual** Scope 1 and 2 emissions are covered by carbon removal projects. No specific percentage limit for total Scope 3 residual emissions has been publicly quantified for the 2030 target.	100% renewable energy for operations (achieved 2020).

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The 1.5° C Pathway

Pledges by Semiconductor Manufacturers (examples)

Company	Key Climate Pledge	Target Date	Carbon Offsetting/Removal Limit (for Net-Zero Goal)	Additional Commitments
Micron	**Net-Zero Emissions** from operations and purchased energy.	**2050**	Aims for **42% absolute emissions reduction** (Scopes 1 & 2) by **2030** from a 2020 baseline. The **residual ≤58% (by 2030)** and final 2050 residual emissions will be addressed via further reductions and neutralization (implied offsetting/removal).	Working toward 100% renewable energy in the U.S. by the end of 2025. Investing $1 billion by 2028 on environmental targets.
TSMC	**Net-Zero Emissions** across the entire value chain.	**2050**	**Emissions reductions aligning with SBTi's ~90% reduction requirement.** The residual emissions will be neutralized / offset.	Reduce emissions to 2020 levels by 2030. 100% renewable energy by **2040**. Overseas operations achieved Scope 1 & 2 net-zero in 2022.
Intel	**Net-Zero Greenhouse Gas Emissions** in global operations.	**2040**	Stated that offsets will be counted toward net-zero only if **all other options have been exhausted**. The overall goal is to cut all possible emissions before relying on offsets.	Working toward 100% renewable electricity globally by **2030**.
Infineon	**Carbon Neutral** (for own operations).	**2030**	Committed to **72.5% absolute reduction** of Scope 1 & 2 by **2030** from a 2019 baseline (SBTi-approved 1.5°C goal). The **residual ≤27.5%** will be offset (or covered by other financial instruments)	Set a Scope 3 target for 72.5% of suppliers (by emissions) to have science-based targets by 2029. Long-term goal of Net Zero Carbon (Scopes 1, 2 & 3) by 2050.
STMicroelectronics	**Carbon Neutral** (for own operations and specific value chain emissions).	**2027**	Intermediate goal of **50% reduction of Scope 1 & 2 by 2025** (SBTi-approved 1.5°C goal). The final 2027 remaining emissions will be **offset** using a portfolio of high-quality nature and technology-based projects.	100% renewable energy sourcing by **2027**.
GlobalFoundries	**Net-Zero GHG Emissions** and 100% carbon-neutral power.	**2050**	Committed to **42% total GHG emissions reduction** by **2030** from a 2021 baseline. The final 2050 goal involves **significantly reducing GHG emissions and offsetting any residuals**.	Goal is to use **100% carbon-neutral power** by 2050.

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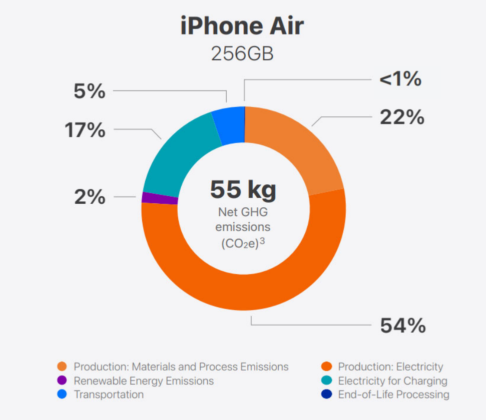
The 1.5° C Pathway

Why is the discrepancy in climate goals an issue?

Life Cycle Greenhouse Gas Emissions

- Frequently dominated by the manufacturing phase, and semiconductor manufacturing in particular



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Semiconductor Climate Consortium (SCC)

A joint industry effort

semi Semiconductor Climate Consortium

Value Proposition

- **Collaborate** on industry value chain goals on **reducing GHG emissions**
- **Learn** how other companies in our value chain are **responding to the climate crisis**
- **Develop tools** for the entire industry value chain
- **Access a network** of peers
- Surface your pain points, **engage toward common solutions**
- Increase your **influence** through a shared consortium voice
- **Strengthen your Materiality assessment** with industry associations and value chain

Activities

Climate Impact Tools

- Evaluation of climate related risks on semiconductor value chain
- Quantification of sector impact
- Business analytics for better decision-making
- BKMs for energy efficiency in manufacturing and chip tech

Reporting Standards

- Provide simplified guidelines for Scope 1, 2, 3 reporting to encourage transparency in the value chain
- Provide market intelligence to stay aligned with disclosure requirements

Technical Workstreams

- Demystify Scope 3 calculations & reports
- Identify infrastructure and process improvements (Scope 1 impacts)

Outreach

- Active member engagement
- Support ESG journey in our value chain
- Partner with NGOs, and local and global Communities
- Promote climate equity

Our role

- Develop rules and requirements for the product carbon footprint data exchange throughout the semiconductor value chain
- Key requirement: Data must be "actionable"

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Let‘s talk carbon

Data pull…

What we heard from the hyperscalers why they are inquiring for data

- IT giants inquire for detailled data and parameters to assess and re-model semiconductor manufacturing on their own

Short-term:

- ✓ **identify hot-spots / map emissions** (to develop GHG reduction strategy)
- ✓ **cooperate** with fabs on GHG reductions
- ✓ **coinvest** alongside suppliers to decarbonise activities
- ✓ **regulation**
- ✓ tracking **progress** of interventions
- ✓ calculating **scenarios, forecasts**
- ✓ **internal carbon prices**

Mid- to long-term:

- ✓ supplier selection (based on comparable PCFs)
- ✓ inform chip design

= mainly **supply chain management**, focussed on taking action, Product Carbon Footprint as Key Performance Indicator, well beyond “reporting only“

Let's talk carbon

…and barriers

What we heard from the semiconductor industry why they do not want to share (too much) data

everything process related is highly confidential data

fair comparison is not possible

huge diversity of PCF requests

risk: possible conclusions about confidential data

fab location: don't want customers to dictate where to manufacture (and to get insights in how capacities are shifted between fabs)

huge portfolio of IC designs

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How to find a compromise

Coordinate and align

Data being actionable is key

1. Agree on a harmonized methodology to calculate product carbon footprints, including how to allocate fab level emissions to individual semiconductor products
2. Agree on a reporting, which is sufficiently transparent while respecting business confidential information, yet allowing downstream users to calculate scenarios
3. Improve data availability from upstream materials and chemicals suppliers
4. Get aligned with other industry initiatives (Catena-X / Semiconductor-X, Together for Sustainability…)

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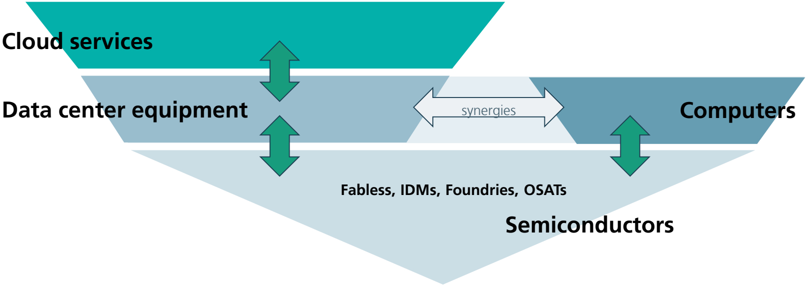
Let's talk carbon

It does not stop at the semiconductor level

The whole ICT value chain needs actionable product carbon footprints



financed by **Google, Meta, Microsoft, AWS** as part of the **Open Compute Project**

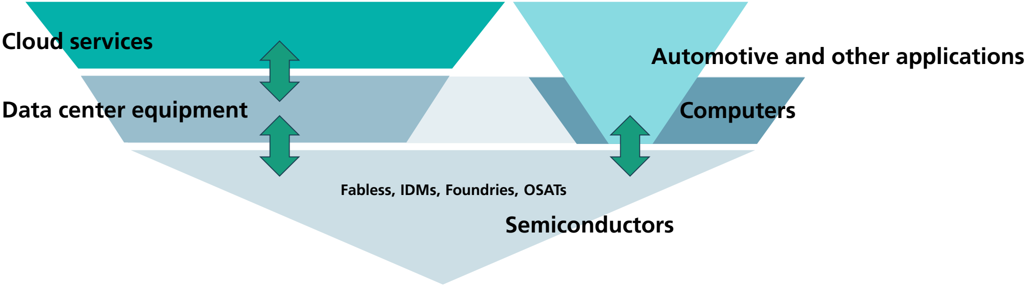
financed by **SEMI** as part of the **Semiconductor Climate Consortium**

Let's talk carbon

It does not stop at the semiconductor level

(Why) is the situation in the automotive industry different?

- Better aligned climate goals, semiconductors contributing less to life cycle GHG emissions



Conclusions

1. Learn from what is going on in the ICT sector currently
2. Get aligned with latest PCF developments and standards
3. Understand Product Carbon Footprints not as a reporting obligation, but as a management tool

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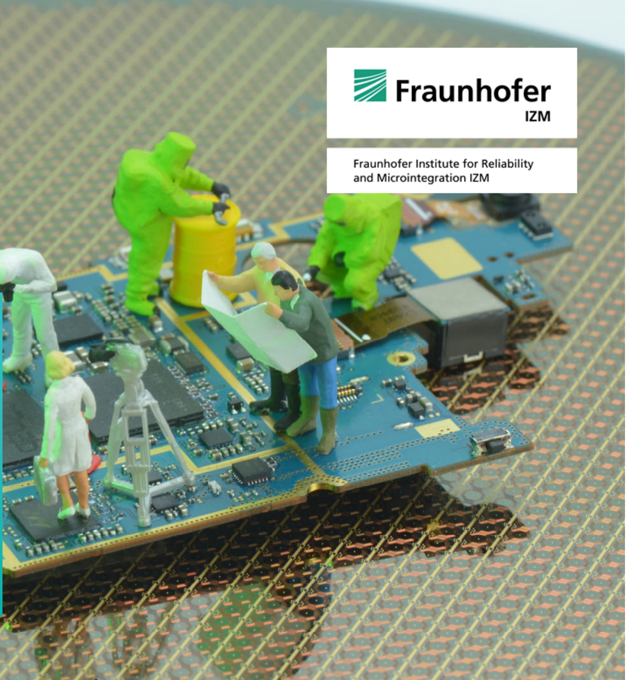

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