DECARBONIZING DATA CENTERS AND SEMICONDUCTOR SUPPLY CHAINS IN THE AGE OF AI

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Renewable Energy Markets™ Asia 2025

Decarbonizing Data Centers and Semiconductor Supply Chains in the Age of AI

29, April 2025

Mousumi Bhat

SEMI Sustainability

Unprecedented Expansion

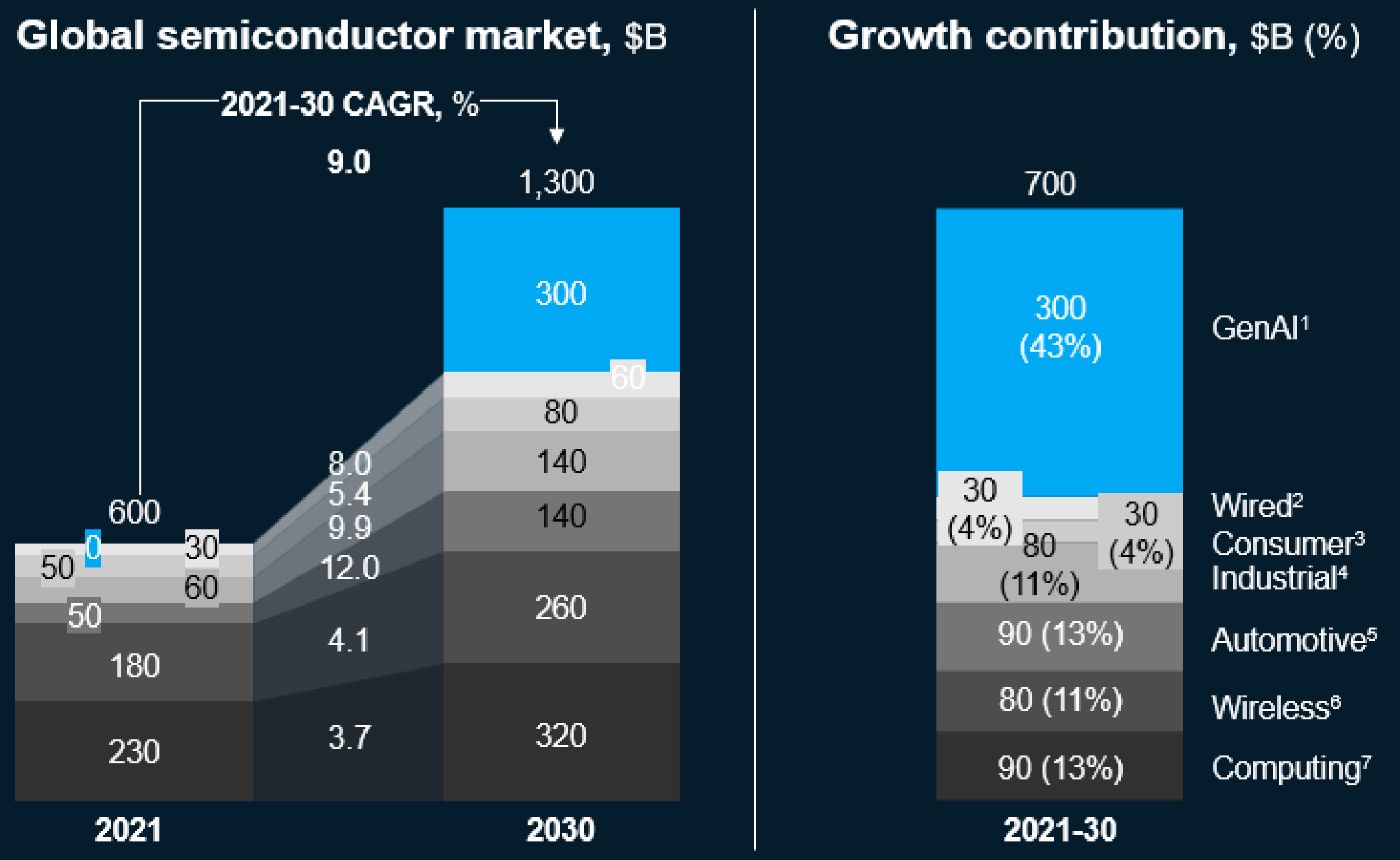
105 New Fabs Coming Online through 2027 – **86** in progress

50+ Additional fabs still needed through 2030

semi

Source: SEMI World Fab Forecast 4Q24 (Dec. 2024)

GenAI semi demand | ~50% of overall semiconductor market growth will be driven by GenAI until 2030



1. GenAI market based on leading edge & memory and base case scenario;
2. Switches & routers, aggregate equipment, CPEs;
3. TVs, Consoles, Smart watches, Home appliances, etc.;
4. Automation, Medical, Test & Measurement, Security, Buildings, Lighting, Power & Energy, Military, Other;
5. Connectivity, Telematics, Infotainment, Drivetrains, Powertrains, ADAS, Chassis, Body & Convenience, Other;
6. Mobile phones, smartphones, tablets, communications infrastructure

Source: McKinsey Analysis, OMDIA

We need to ensure consistent mapping of emissions across categories

Upstream value chain
FAB Scope 3 upstream

- Raw material extraction & processing
- Parts & components
- Fab inputs (Wafers, equipment & materials)

Device Production
FAB Scope 1+2

- Chip Design
- Chip Fabrication
- Assembly & testing

Downstream value chain
FAB Scope 3 downstream

- ICT industry
- Society
- End-of-Life

I. Low Carbon materials

Raw materials (OPEX)

- Chemicals
- Wafers
- Gases
- Metals
- Slurry, pads, conditioners
- Quartz, plating, reticles
- Other

PP&E (CAPEX)

- Buildings
- Equipment
- Infra
- Other

II. Low carbon mobility

- Logistics
- Business travel
- Employee commuting
- Other

III. Scope 1 emissions – by location

By Process

- Dry etch
- CVD
- PVD
- Wet etch
- EPI
- Litho
- Diffusion
- CMP
- Implant
- Metrology
- Rest

By Gas

- NF3
- NGAS
- TDMAT
- CO2
- SF6
- C4F8
- PH3/N2
- N2O
- CF4
- HCL
- Other

Abatement %

IV. Scope 2 emissions – by location

By Process

- Dry etch
- CVD
- PVD
- Wet etch
- EPI
- Litho
- Diffusion
- CMP
- Implant
- Metrology
- Rest

Energy type

- Coal
- Biomass
- Natural gas
- Solar
- Geothermal
- Hydropower
- Nuclear
- Wind offshore
- Wind onshore
- Other

Energy carbon intensity

V. Energy use by digital tech

- Computing & data storage
- Wireless communication
- Automotive electronics
- Industrial electronics
- Consumer electronics
- Wired communication

VII. End of life

VIII. Carbon removal

These are tough problems to solve

No one country, company or CEO can solve this alone

Collaboration along the value chain – runway is short. We *need* **to** *lean in and learn fast*

Innovation is essential *across all sections, including green chemistry, grid and climate technology*

Design your operations *with consideration of Social and Manufacturing Cost of Carbon*

Thank You!