THE WORLD OF SEMICONDUCTORS: A TECHNOLOGY WAR

IndustriAll Europe

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#1

A GEOPOLITICAL CONTEXT THAT IS RESHAPING THE WORLD OF SEMICONDUCTORS

THE WORLD OF SEMICONDUCTORS: A TECHNOLOGY WAR

Chips everywhere	Chips key to AI, 5G, critical military uses	Covid-crisis	Components shortage
US Chip and Science Act	US Inflation Reduction Act	US sanctions against Huawei 2017, 2018, 2019	US tech* restrictions on China
EU growing awareness about dependency	EU Foreign Investment screening mechanism	EU Chips Act	EU Critical Raw Materials Act
Made In China 2025 plan	Chinese huge investments in chips	Many Chinese M&As blocked in the US**	China weighting Rare earths ban

* Tech = semiconductor, AI and quantum computing ** Semiconductors companies such as Micron and Lattice

WHAT IS AT STAKE? US DOMINATION

- **The US is trying to resist and limit China's rise**. If China is attempting to challenge US domination, the US aims to maintain it.
- What's going on in the semiconductor sector illustrates this arm wrestle.
- The US has progressively enacted rules to limit China's technological development including recently some restrictions in the most critical technologies that are AI, quantum computing and semiconductors.
- The US is trying to have on board key countries and companies. There is an attempt to forge a US-led alliance with South Korea, Taiwan and Japan. Despite some reluctances.
- And the same goes with Dutch ASML which is a supplier of key equipments that the US wants to stop selling to China.

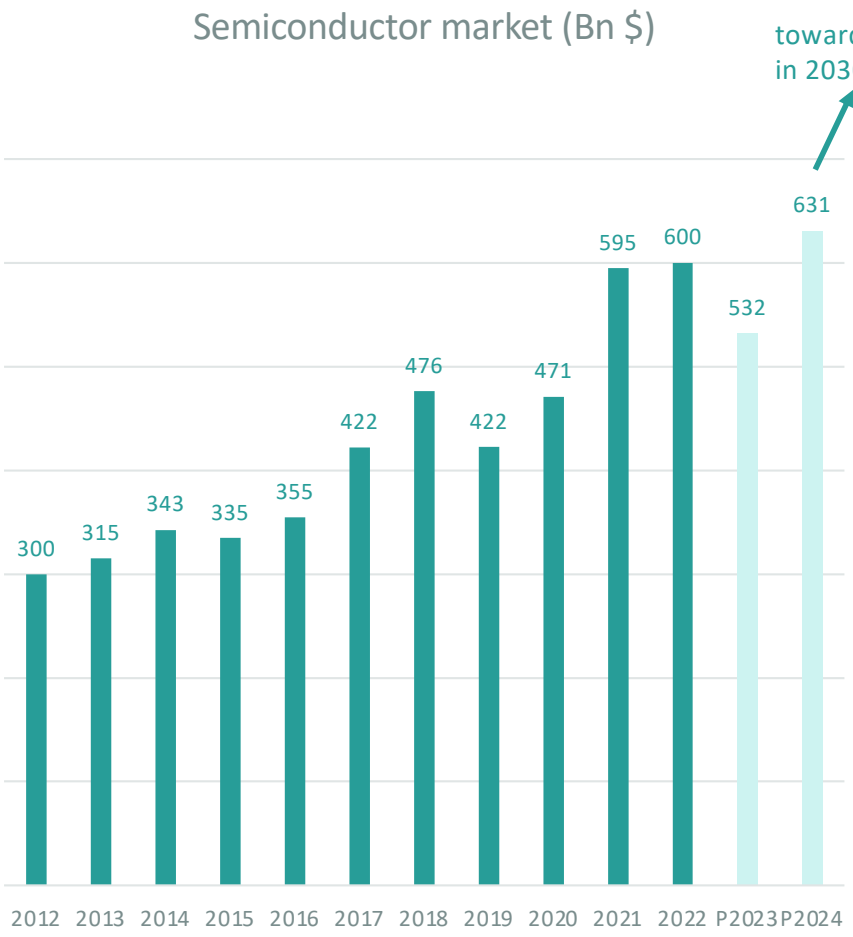
MAIN FEATURES OF THE SEMICONDUCTOR INDUSTRY

High growth industry	▪ 7,5% CAGR 1990-2010 ▪ 7% CAGR 2021-2030
CAPEX intensive industry	▪ Rising costs of fabs ▪ Less and less players able to invest
High R&D investment	▪ High R&D expenditures as a percent of Sales ▪ US companies are investing more
Highly cyclical industry	▪ Strong correlation with GDP ▪ Overreaction with GDP evolution
Concentration and oligopolistic industry	▪ ASML quasi-monopoly (lithographic tools) ▪ ARM quasi-monopoly (architecture) ▪ TSMC quasi-monopoly (foundry) ▪ Samsung/Hynix/Micron oligopoly (DRAM memory) ▪ Samsung/Hynix/Kioxia/Western Digital/Micron (Nand flash memory)

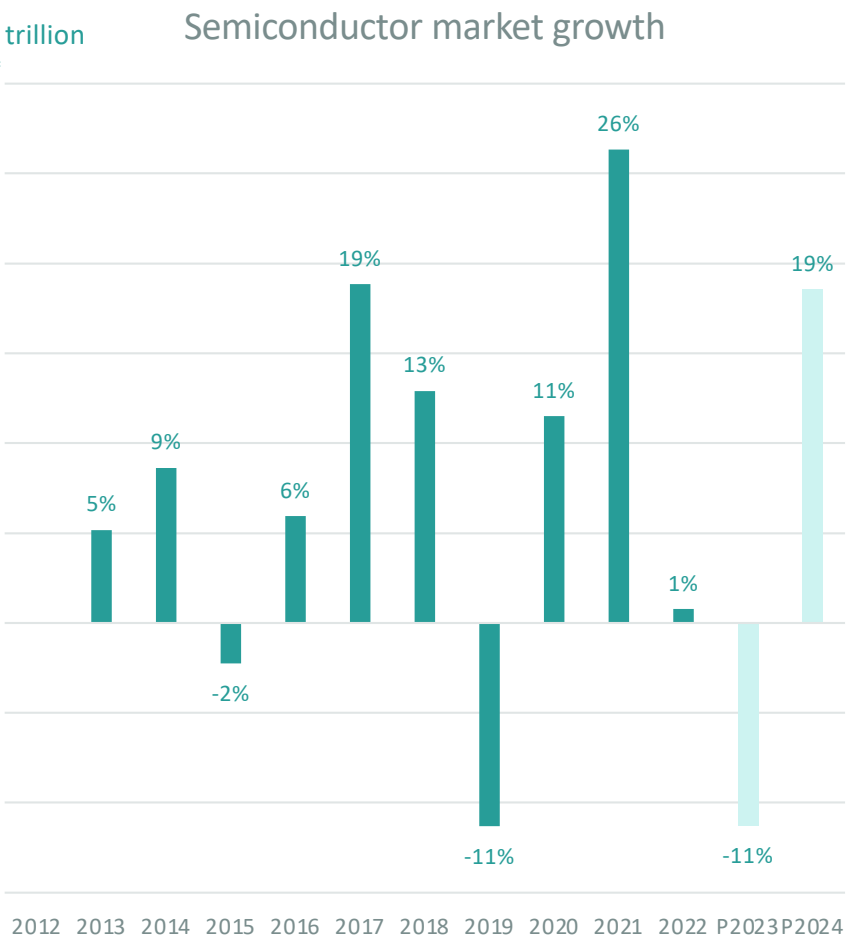
#2

MAIN STRIKING FIGURES

A CYCLICAL MARKET WITH A STRONG MEDIUM-TERM GROWTH TREND



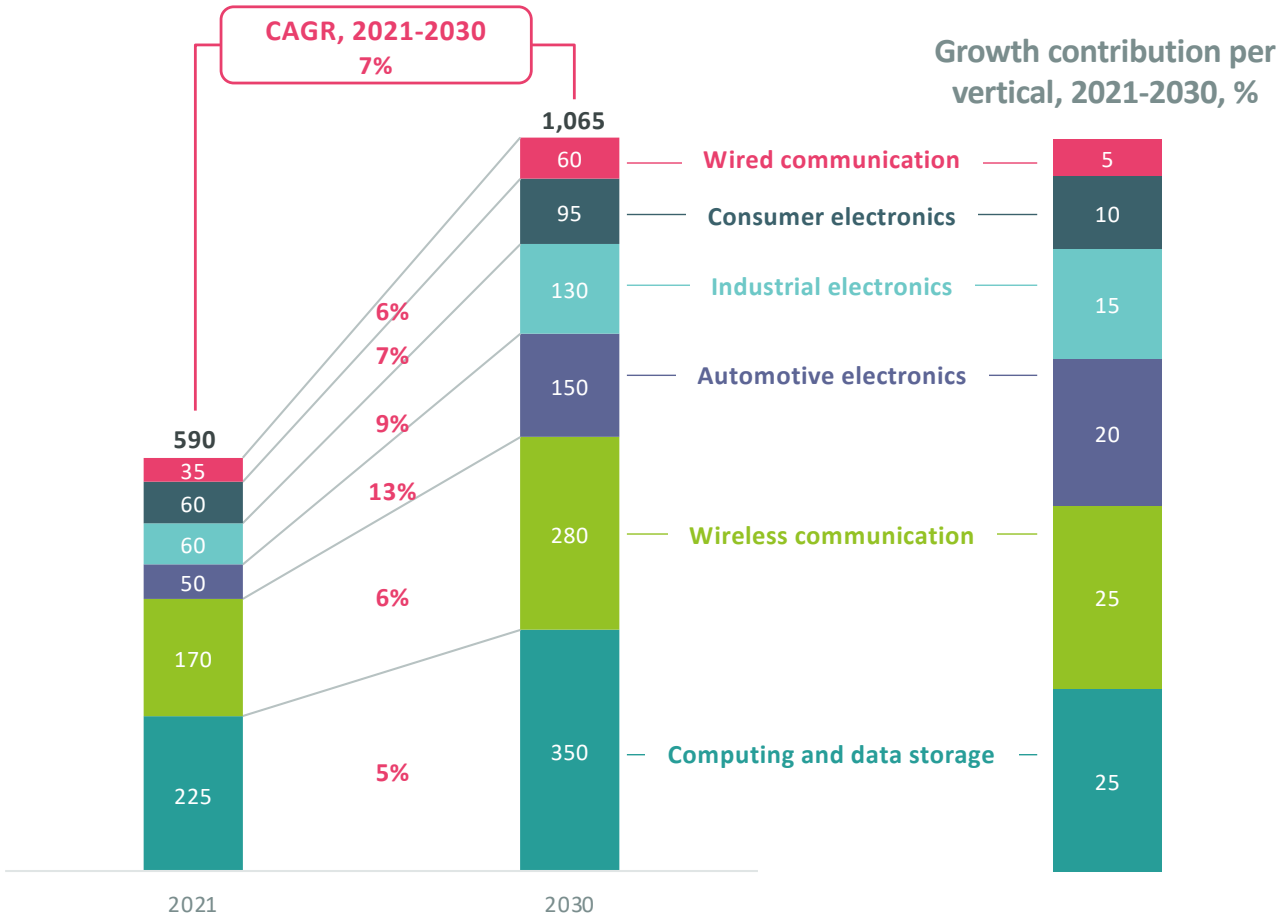
Gartner 2023
* Micheal Hall estimate



Gartner 2023

THE SEMICONDUCTOR MIGHT GROW TO 1 TRILLION BY 2030

Global semiconductor market value by vertical, indicative $ billion.

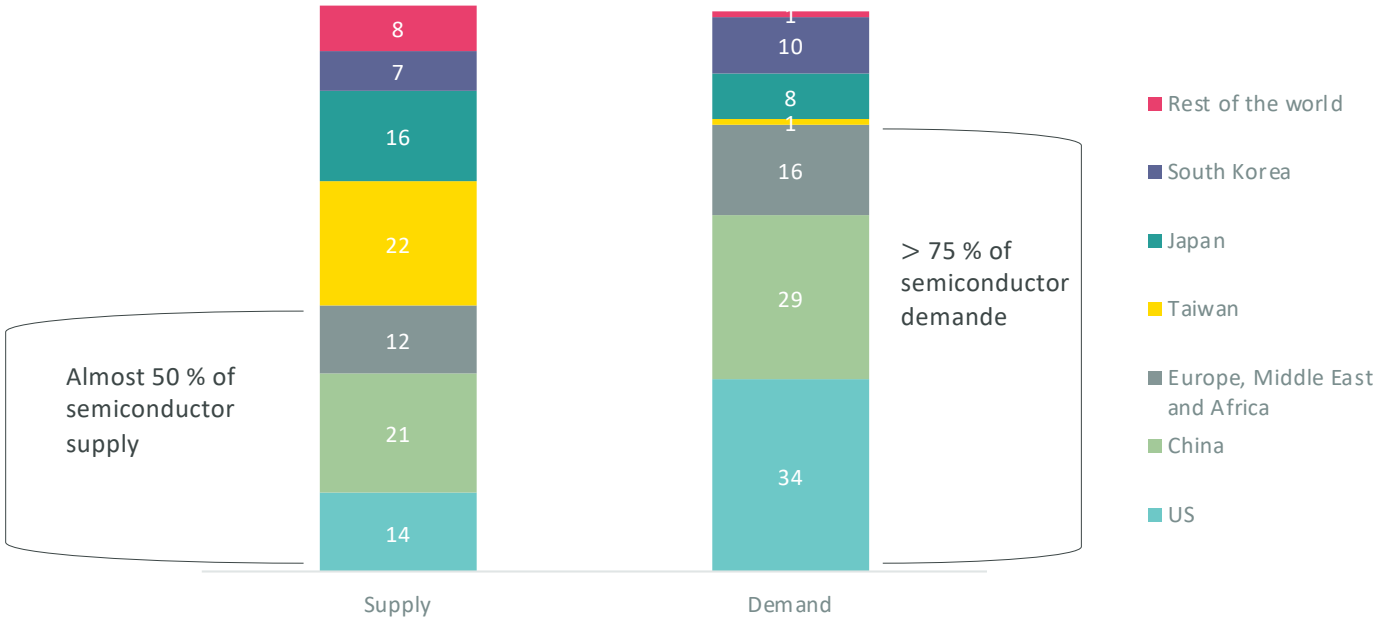


Source: The semiconductor decade a trillion-dollar industry. McKinsey. April 2022

- Growth is driven by wireless, automotive and data storage and even industrial electronics.
- It might favour European players.

SEMICONDUCTOR SUPPLY AND DEMAND IS NOT REGIONALLY BALANCED

Semiconductor supply and demand, by region in 2021, % share

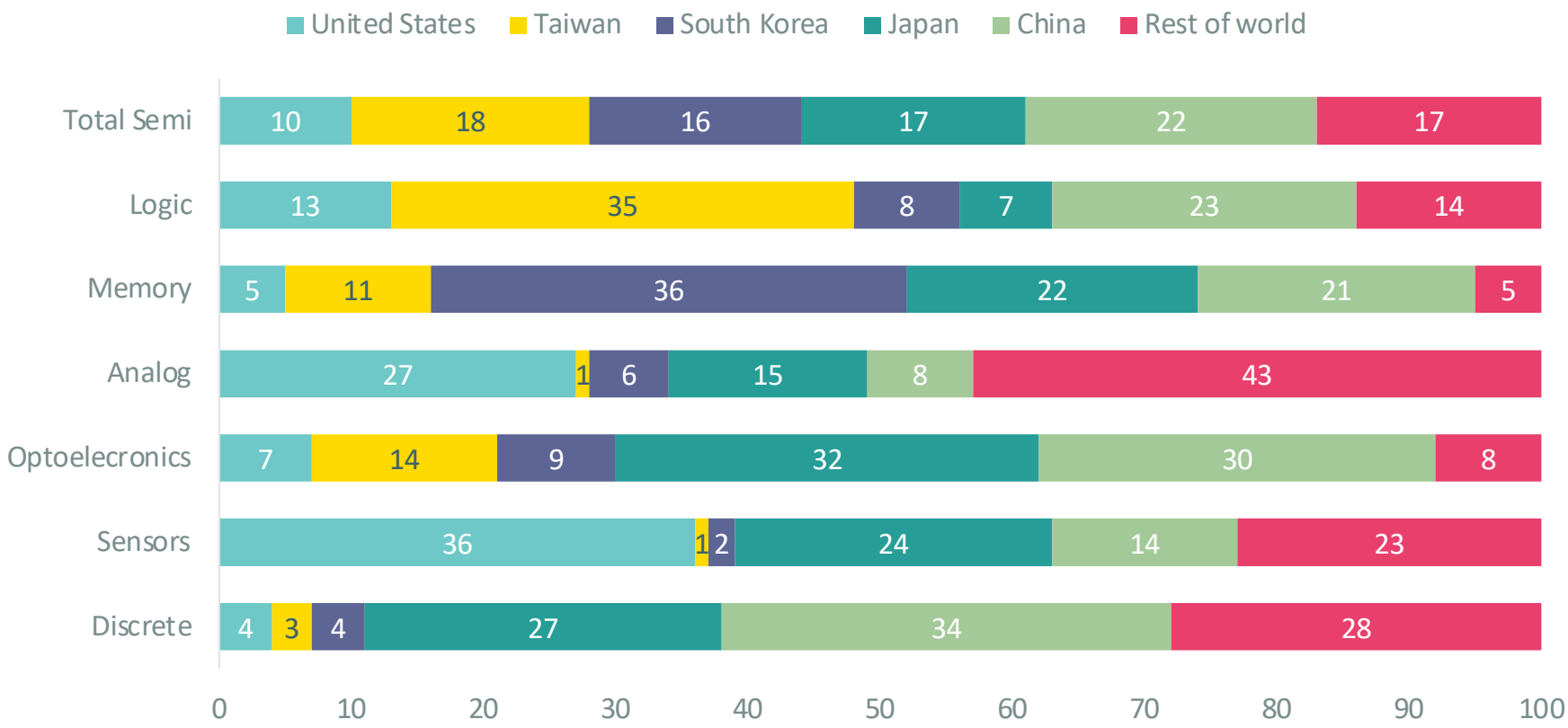


Source: Semiconductor fabs: Construction challenges in the US. McKinsey & Company. January 2023.

- Europe fell from 30% in 1990 to 12% in 2019.
- US production fell from 37% to 14% in the meantime.

PRODUCTION IS MOSTLY DONE IN ASIA: TAIWAN, S. KOREA, JAPAN AND CHINA

WAFER MANUFACTURING CAPACITY BY FAB LOCATION AND CHIP TYPE, 2020

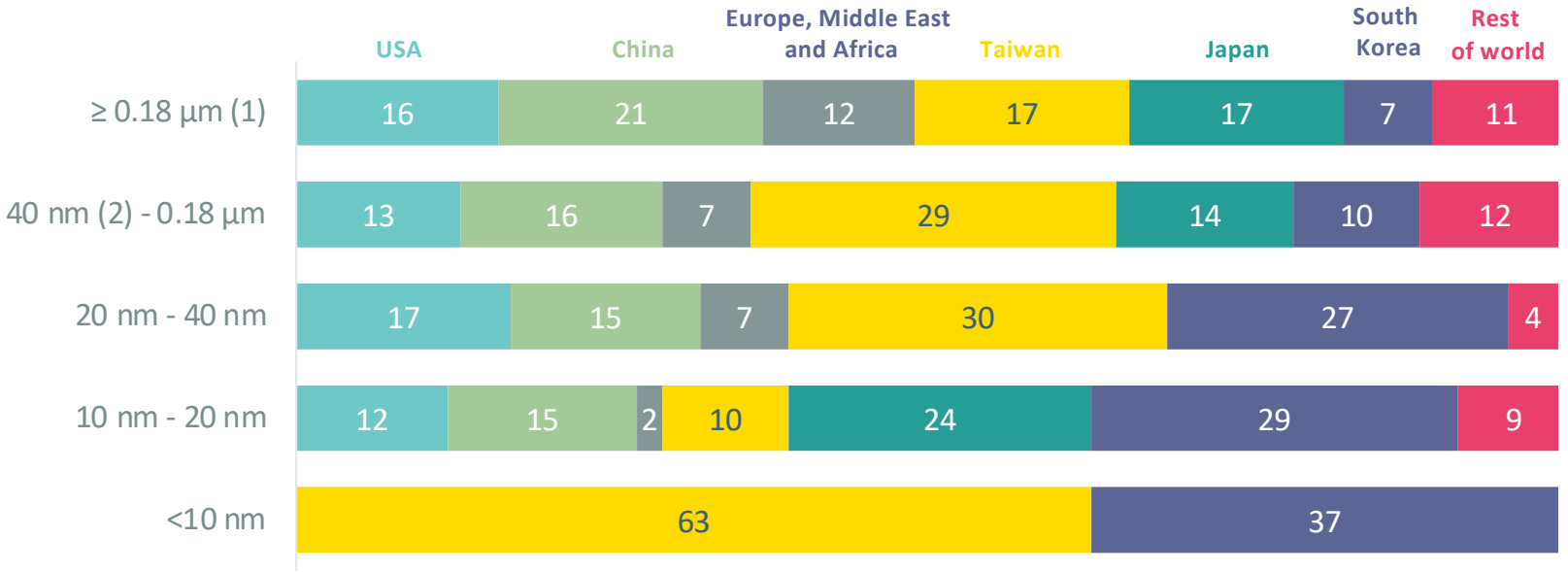


Source: CRS, adapted from SEMI, *World Fab Forecast*, Novembre 2020.

THE MOST ADVANCED TECHNOLOGY IS IN THE HANDS OF TAIWAN AND SOUTH KOREA

Regional semiconductor chip production varies by node size.

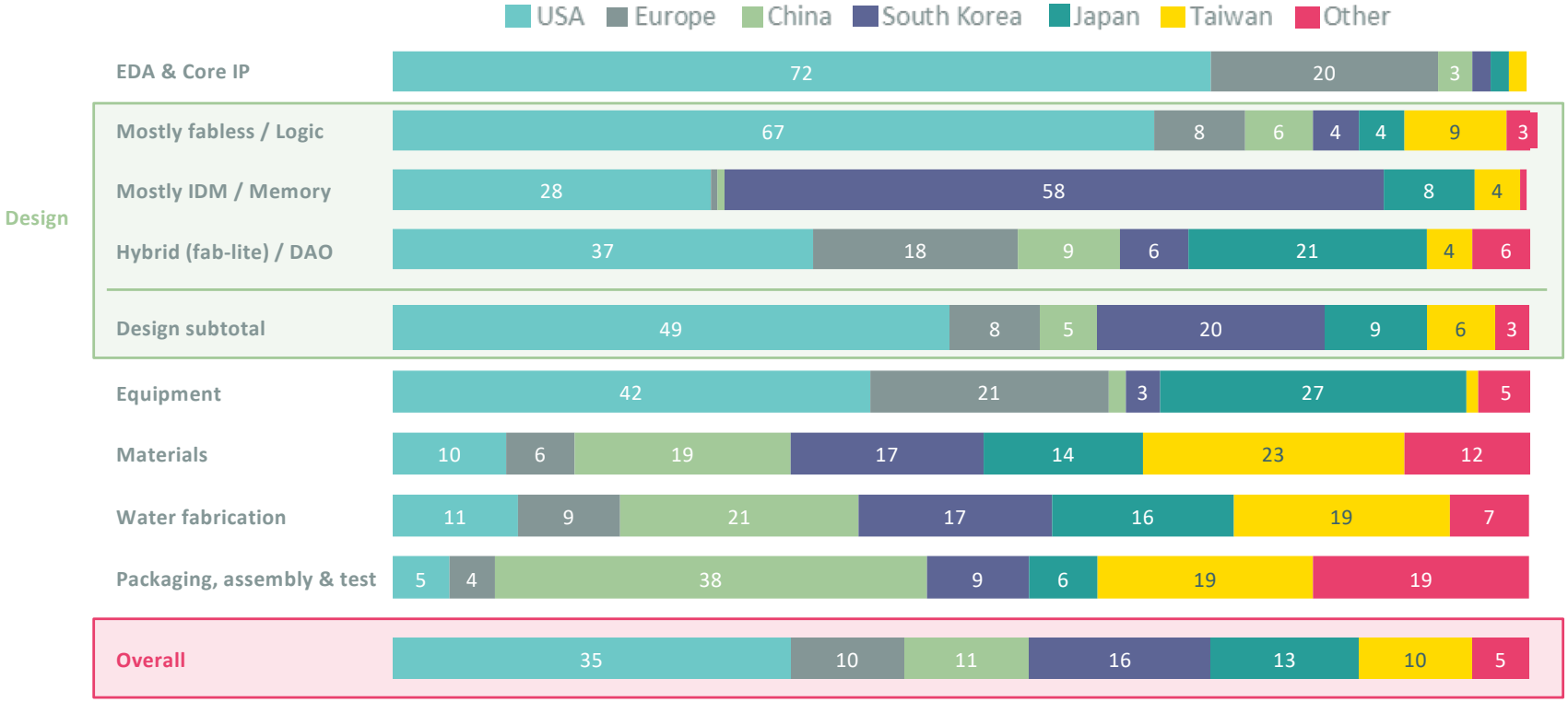
Installed worldwide capacity, by node size, December 2020, %



(1) Micrometer.
(2) Nanometer.
Sources: IC Insights; IHS Markit; SEMI World Fab Forecast database.
Semiconductor fabs: Construction challenges in the US., McKinsey & Company, January 2023.

VALUE ADDED (DESIGN) REMAINS LARGELY AMERICAN

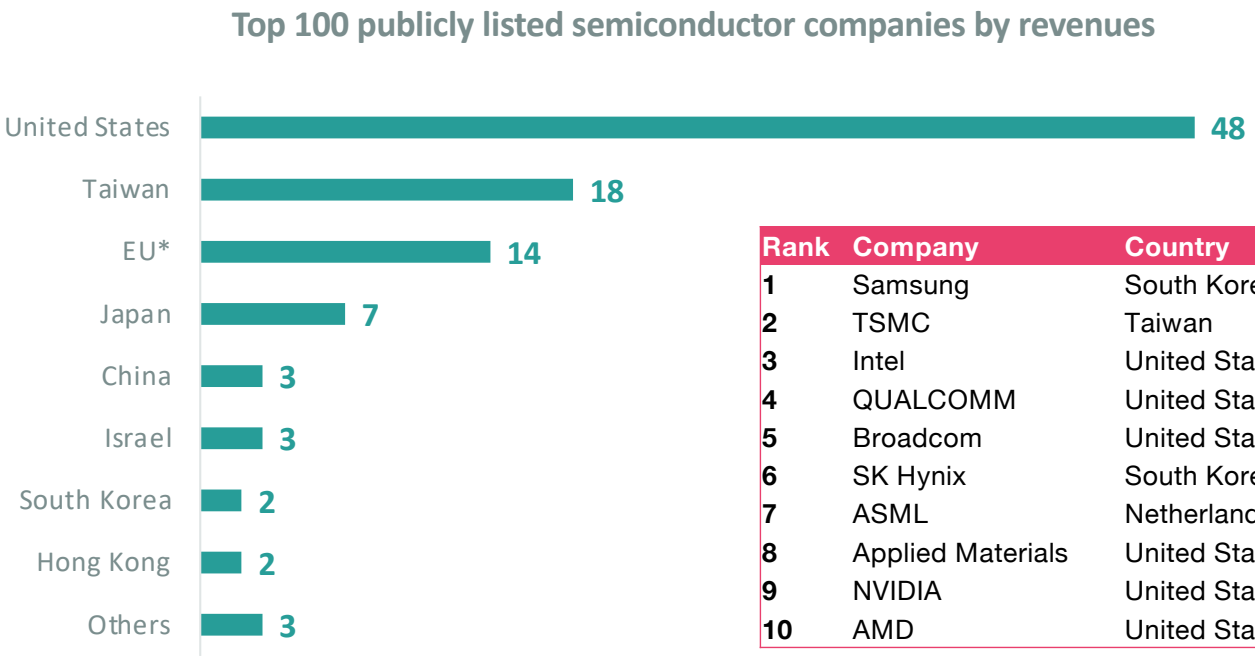
Semiconductor industry value added by activity and region 2021 (%)



Source : 2022 STATE OF THE U.S. SEMICONDUCTOR INDUSTRY. SIA

- Valued added angle doesn't give a more favourable view of Europe's situation.
- The US keep a strong share of the VA albeit deindustrialisation.
- Wafer fabrication and PAT are overwhelmingly in Asia.

THE WORLD TOP PLAYERS ARE AMERICAN AND ASIAN



Rank	Company	Country	Revenues - M$
1	Samsung	South Korea	218 047
2	TSMC	Taiwan	72 005
3	Intel	United States	54 044
4	QUALCOMM	United States	38 584
5	Broadcom	United States	35 042
6	SK Hynix	South Korea	28 298
7	ASML	Netherlands	27 424
8	Applied Materials	United States	26 638
9	NVIDIA	United States	25 878
10	AMD	United States	21 876

Source : companiesmarketcap.com

- ASML is providing equipments to semiconductor players. It is not strictly speaking a semiconductor company.

- The first Chinese company is ranked 29.
- Europe has only 14 companies in the top 100.

ONLY 4 EUROPEAN PLAYERS MAKE IT IN THE TOP 20

Rank	Company	Country	Revenues - M$	Employees
7	ASML	Netherlands	27 424	37 704
15	STMicroelectronics	France/Italy	17 318	51 370
16	Infineon	Germany	17 240	57 217
19	NXP Semiconductors	Netherlands	13 177	34 500
39	ASM International	Netherlands	2 877	4 258
45	AT&S	Austria	2 026	14 403
46	Siltronic	Germany	1 851	4 500
60	Soitec	France	963	1 986
62	Melexis NV	Belgium	923	1 900
70	X-FAB	Belgium	769	4 200
79	BE Semiconductor	Netherlands	635	1 682
80	Technoprobe	Italy	588	2 120
87	Aixtron	Germany	475	974
91	Magnachip	Luxembourg	338	897

Source : companiesmarketcap.com

- ST Microelectronics is listed in Switzerland but can be deemed as a European player in this chart
- ASM International like ASML is providing equipments to semiconductor players. It is not strictly speaking a semiconductor company.

#3

A GROWING PUBLIC FUNDING TREND

JOHN PODESTA, A WHITE HOUSE ADVISER: "AMERICA IS THE BEST PLACE IN THE WORLD TO INVEST, AND IF YOU DON'T BELIEVE ME, LOOK AT THE PROTESTS FROM OUR ECONOMIC PARTNERS."

BLOSSOMING PUBLIC PLANS ALL OVER THE WORLD

- EU Chips Act €43 bn
- S. Korea K-semiconductor Belt strategy
- US Chip and Science Act: $52,7 bn
- 2021 Japanese $6,8bn funding
- Taiwan additional tax incentives
- Thailand preferential tax policy for semiconductor investments
- Vietnam tax incentive policy for chip firms
- India $10 bn incentive package for semiconductor investments
- Mexico incentive package for semiconductor investments
- Canada incentives for semiconductor investments

HEAVY PUBLIC SUBSIDIES FOR INVESTMENTS IN NEW FABS IN EUROPE (+ ISRAEL)

Company	Country	Total investment	Total public subsidies	Part of public subs/total investment (%)
Intel	Germany Magdeburg	30 €bn	10€bn	33%
Intel	Ireland Leixlip	12 €bn		
Intel	Poland Wroclaw	4,6 €bn		
Infineon	Germany Dresden	5 €bn		
STM/GF	France Crolles	7,5 €bn	2,9 €bn	38,6%
TSMC*	Germany Dresden	10 €bn	5 €bn	50%
Intel	Israel	25 $bn		12,8%

*TSMC is investing 3,5 €bn helped by other investors (NXP, Infineon, Bosch) to make a total of 10 €bn

- Investments in Europe seem to be concentrated in France, Italy and Germany. Not everyone might benefit from a European bounce back.

MAJOR INVESTMENTS IN NEW FABS AND PUBLIC SUBSIDIES IN THE US

Company	Country	Total investment	Total public subsidies	Part of public subs/total investment (%)
Samsung	US Taylor, Texas	17,3 $bn	4,8 $bn	27,7%
Intel	US Arizona	20 $bn		30% ?
TSMC	US Arizona	40 $bn	Seeking 15 $bn	
Micron	US Syracuse, NY	20 $bn		
Micron	US Boise, Idaho	15 $bn		

INVESTMENTS IN FABS AND PUBLIC SUBSIDIES IN SOUTH KOREA AND JAPAN

Company	Country	Total investment	Total public subsidies	Part of public subs/total investment (%)
Samsung	Yongin. South Korea 5 new plants	227 $bn		50% tax credit for investment in R&D and up to 20% for facility investment
Hynix	Yongin. South Korea 4 new plants	106 $bn		50% tax credit for investment in R&D and up to 20% for facility investment
TSMC	Japan	8 €n	3,2 €bn	40%

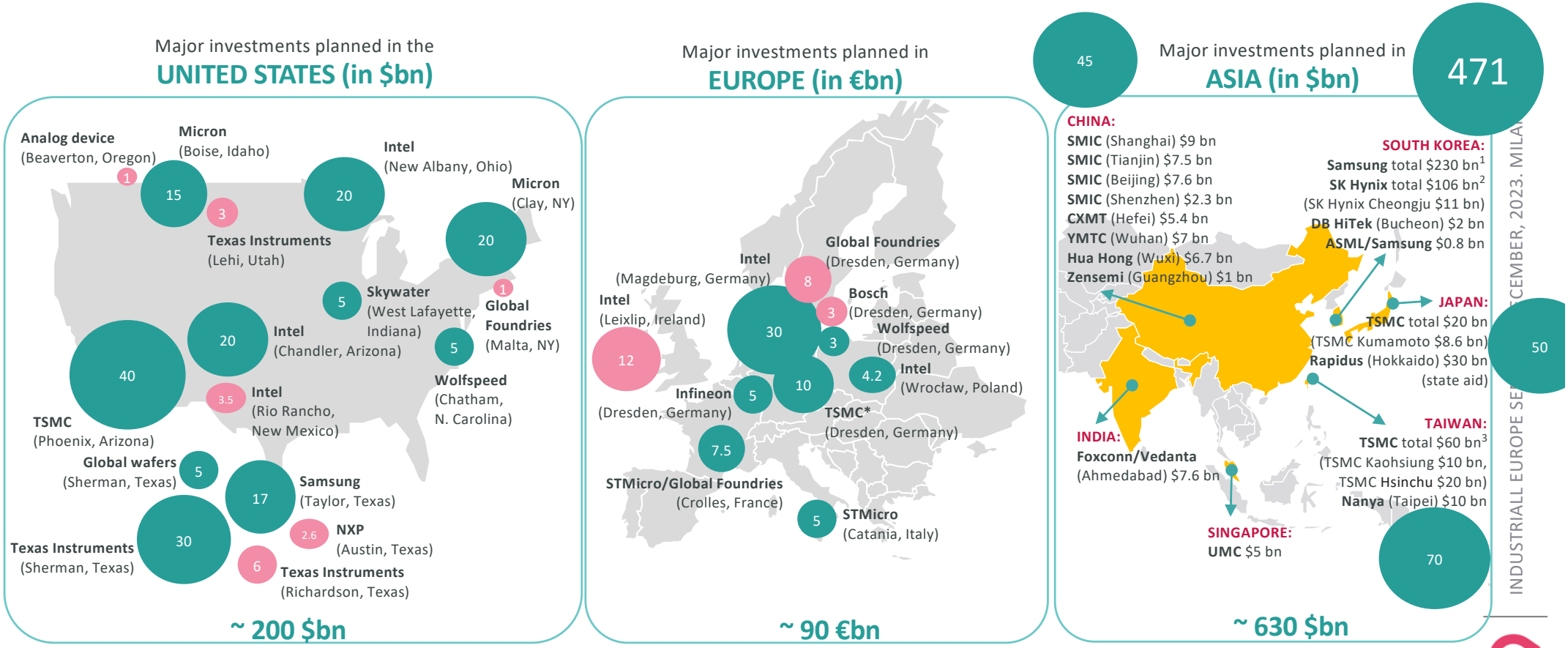
- South Korea is also favouring its giants through tax credits and other kind of support.

THE GIGANTIC KOREAN PLAN

- South Korea intends to build the world biggest semiconductor cluster in Gyeonggi Province by 2047. It includes 16 new fabs in an area that hosts already 19 fabs and 2 research centers.
- Samsung will build
  - 6 new fabs in Yongin (272 $bn)
  - 3 new fabs in Pyeongtaek (90 $bn)
  - 3 research fabs in the Giheung district (15 $bn)
- SK Hynix will build 4 fabs in Yongin (92 $bn).
- The amount mentioned here are enormous although they are planned on a more than 20-year period.

THE SCALE OF INVESTMENTS PLANNED IN EUROPE IS MODEST WHEN COMPARED TO THE US AND ASIA

The European **20% objective** by 2030 could prove difficult to reach once considered the scale of investments planned in **South Korea** and **Taiwan**, but also the **United States**.



[1] five new plants by 2042
[2] four new plants
[3] over five years

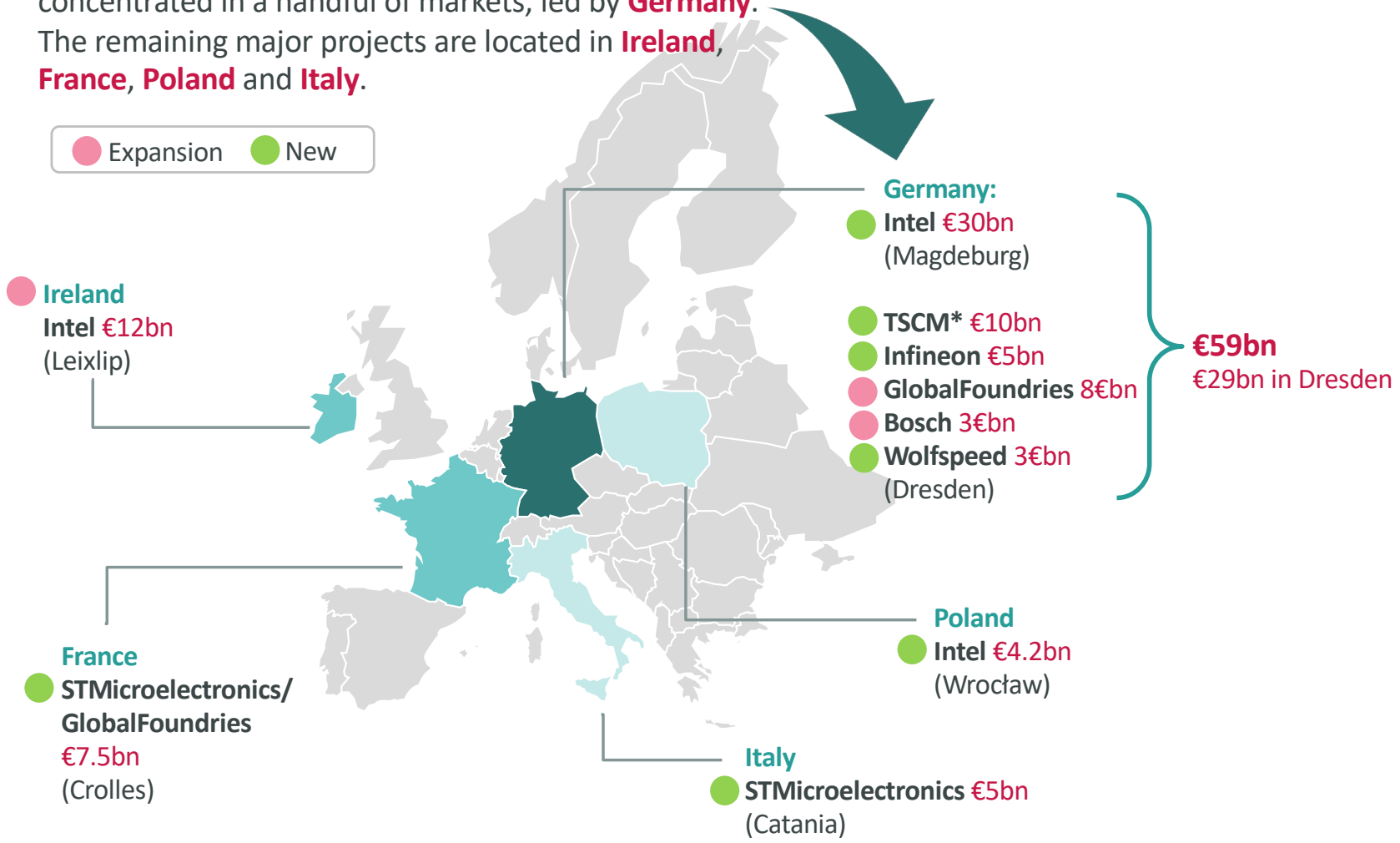
* TSMC, Bosch, NXP and Infineon joint project

Investments in South Korea are planned by 2047.
And by 2030 in the US.

Source: Syndex

THE SPLIT OF INVESTMENTS IN EUROPE SHOWS A SIGNIFICANT REGIONAL IMBALANCE

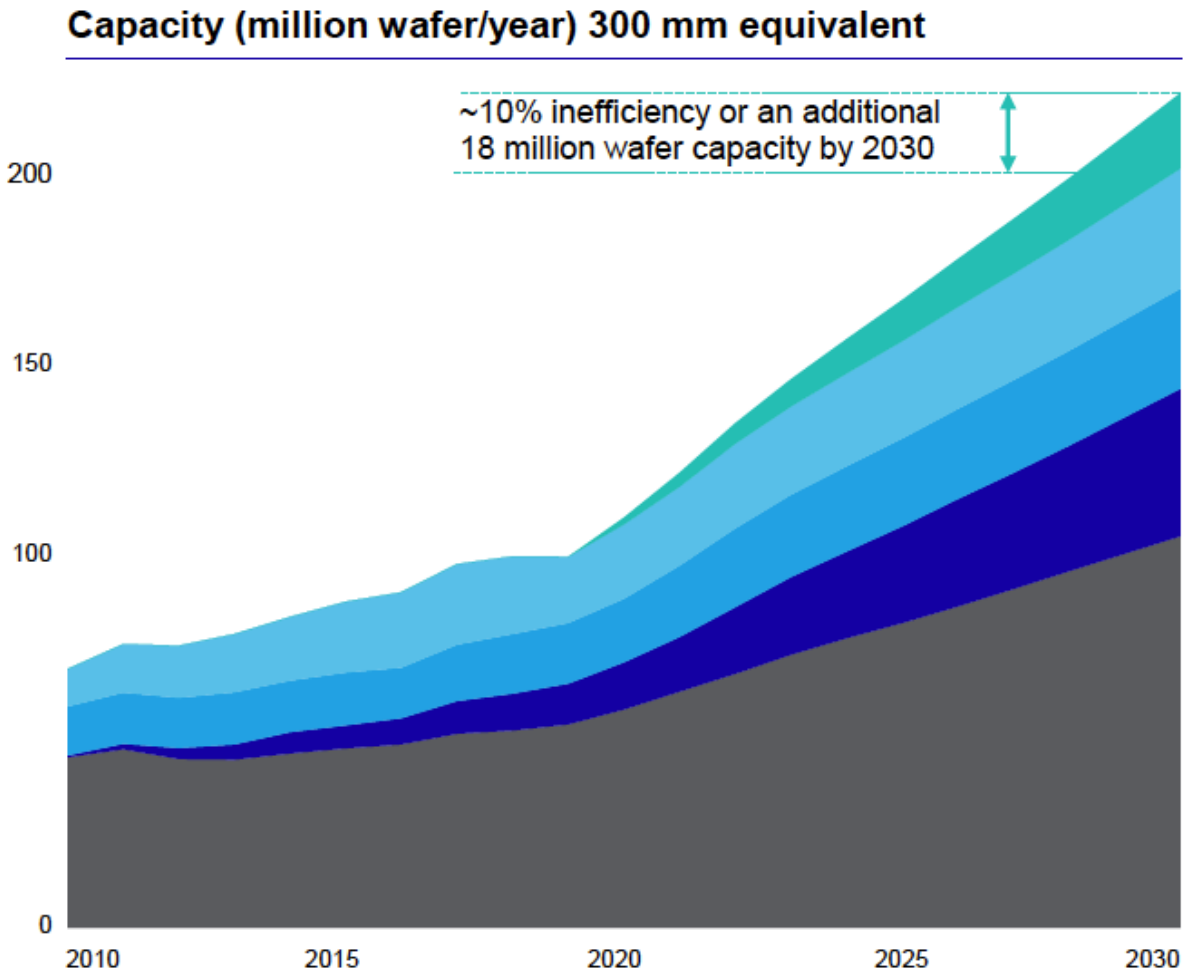
The bulk of planned investments in Europe remains so far concentrated in a handful of markets, led by **Germany**. The remaining major projects are located in **Ireland**, **France**, **Poland** and **Italy**.



* TSMC, Bosch, NXP and Infineon joint project

Source: Syndex

TECHNOLOGICAL SOVEREIGNTY MIGHT CREATE OVERCAPACITIES



Source: ASML analysis, advanced Logic ≤28 nm, mature >28 nm

#4

CONDITIONALITY OF PUBLIC SUPPORT : WHAT CAN BE DONE?

TAX DUMPING AND COMPETITION BETWEEN STATES

The total public money spent by…US, China, Japan, S. Korea and the EU

= > $721bn of public aid

= 0,9% of 2020 world GDP!

- Opportunity for companies to bargain and get higher subsidies.
  - i.e.: Intel/Germany
- **More and more countries are doing the same to attract investments** (Malaysia, Thailand, Vietnam, Canada etc.).
  - The EU aims to double its production.
  - The US are pushing hard to attract investments from TSMSC and Samsung among others.
  - South Korea is also investing a lot of money.
- Semiconductor companies generate huge profits !
- **Do they really need these subsidies?**

CONDITIONALITY OF PUBLIC AID: WHAT POTENTIAL FOR WHAT RISKS?

- Conditionality of public aid appears to be limited in general within the EU, or more specifically for schemes dedicated to semiconductors.
  - **Tax credits** (such as the research tax credit in France) often introduce few or no economic or fiscal constraints, or even constraints in terms of workforce trajectory,
  - The question of introducing **quantified conditions** in the granting of such aid arises in the context of forecasts of massive aid on an EU scale.
- It could be worth highlighting a number of risks or limits to the conditionality of public aid:
  - A **high risk of cliff effects** when the obligation is lifted,
  - The introduction of **restrictive rules** in one country/region **may discourage investment** in favor of other geographical areas,
  - Adaptation to any **review of the CAPEX plan** (cf. cyclicality, risk of overcapacity, etc.).

SEVERAL TYPES OF CONDITIONS CAN BE MOBILIZED

Source : Mariana Mazzucato and Professor Dani Rodrik, Industrial Policy with Conditionalities: A Taxonomy and Sample Cases, October 2023 ; Conditionnalities in industrail Policy, Julia Pamilih, November 2023

Type of firm behavior targeted	• **Affordable access ; Directionallity towards socially desirable goals ; Profit-sharing ; Reinvestment** • Example - • Israel's High-Tech R&D Investment Incentives offered support for high-risk R&D projects. Funding was conditional on profitable firms repaying the grant, and know-how can't be transferred abroad.
Fixed versus negotiable/iterative conditions	• **Some program requirements may be fixed or linked to firm characteristics, while others may be negotiable** • *Example - The German national investment bank Kreditanstalt für Wiederaufbau (KfW) introduced an Energy Efficient Refurbishment and Construction Program with low-interest loans contingent on meeting energy efficiency standards. Under this program, the building standards and interest rates are fixed, but there is flexibility over the repayment terms.*
Risks/rewards sharing mechanism	• **The degree to which risks and rewards are divided between the public and private sectors.** • *Example - During the Covid-19 pandemic, AstraZeneca and the University of Oxford signed a landmark deal with the UK Government for the non-profit production of vaccines. The contract reduced risk by guaranteeing manufacturing demand, while the UK government secured public health benefits.*
Measurable performance criteria & monitoring and evaluation	• **Industrial policy may contain criteria for monitoring and evaluation, but there is variation in who makes the assessment and how.** • *Example - The US CHIPS and Science Act sets clear criteria for funding applications based on economic and national security objectives, and other criteria including commercial viability. One high-profile criteria is that CHIPS funds limit recipients from any "material expansion of semiconductor manufacturing capacity" in countries of concern.*

THE US CHIPS ACT EXAMPLE

- The US Chips Act imposes a number of conditions that could inspire the European Union in this area:
  - Recipients who receive more than $150 million in direct funding "will be required to share with the U.S. government a portion of any cash flows or returns that exceed the applicant's projections by an agreed-upon threshold".
  - Companies winning funding are also prohibited from using chips funds for dividends or stock buybacks and must provide details of any plans to buy back their own shares over five years.
  - Applicants seeking more than $150 million in direct funding must submit "a plan for how they will provide affordable and accessible childcare for their workers."
  - Applicants should also "create opportunities for minority owned, veteran-owned, and women-owned businesses; demonstrate climate and environmental responsibility; invest in their communities by addressing barriers to economic inclusion; and commit to using iron, steel, and construction materials produced in the United States."
  - Companies winning awards will be required to enter into agreements restricting their ability to expand semiconductor manufacturing capacity in foreign countries of concern like China for 10 years after winning funding. They cannot engage in any joint research or licensing efforts with a foreign entity of concern involving sensitive technologies.

INTERESTING AVENUES TO EXPLORE IN TERMS OF AID CONDITIONALITY, WHICH COULD ULTIMATELY ALIGN THE INTERESTS OF ALL STAKEHOLDERS.

Employment conditions

- A stability or growth term for the workforce within the UE, with a duration to be set according to the duration of the investment.
- Obligation to devote part of the aid (5%?) to training programs for employees in the European Union (a job in which a company has invested in training is potentially less risky).

Conditions on profit-sharing

- Better sharing of added value: obligation to set up or improve profit-sharing mechanisms.
- Clause requiring profits to be reinvested within Europe (particularly for R&D).

Social/Environmental conditions

- Emissions reduction clause
- Water use commitments
- Inclusion clauses
- ...

- **It is important to provide for total or partial reimbursement of public aid in the event of non-compliance with the conditions initially set out.**

#5

SKILLS SHORTAGE AND EUROPEAN REINDUSTRIALIZATION

THE QUESTION OF SKILLS APPEARS TO BE CRUCIAL AND EVEN A PREREQUISITE FOR THE SUCCESS OF CAPACITY INVESTMENTS.

- **It takes at least 2 years for a new fab to go into production.**
- **But setting up training programs takes at least 5 years before producing any structuring effects.**
- This shows that an efficient training strategy is an essential prerequisite for the success of an ambitious semiconductor plan ... and should even be launched as far as possible in advance of CAPEX realization
- In fact, all geographical regions are already experiencing recruitment difficulties in the majority of professions: technicians, electronics engineers and software engineers.
- However, the investments planned on an international scale are going to mean a sharply growing need for resources in each of these job families.

PHOTO AND OUTLOOK FOR THE INDUSTRY'S QUANTITATIVE RESOURCE REQUIREMENTS

- The Deloitte report "The Global Semiconductors talent shortage“ (2022) summarizes the **current labor shortages by region or for the short term**:
  - **US**: between 70 k and 90 k employees ; **Taiwan**: 30 k employees ; **Japan**: 35 k employees ; **South Korea**: 30 k employees ; **China**: 300 k employees ; **Europe**: information not available
- The same report outlines the **50% increase needed** between now and 2030 to support the announced investments and the ambition to reach the trillion-dollar mark on the semiconductor market: **the number of employees in the sector would rise from 2 to 3 million worldwide**.
- The **pressure on recruitment** is all the greater as Big Tech (Meta, Google, Amazon, Alibaba, Tencent, etc.) and the major automotive players (Ford, Tesla, etc.) are developing their own chip design teams.
- **All geographical zones are already experiencing a shortage of resources that is set to grow** in the years ahead.

ON THE QUALITATIVE SIDE, A WIDE RANGE OF SKILL REQUIREMENTS AND INCREASED COMPETITION FROM CURRENTLY MORE ATTRACTIVE SECTORS

- The competencies destined to grow in volume will be extremely varied, with **strong growth in software skills requirements** in particular:
  - electricians, pipefitters, and welders;
  - technical engineers, maintenance personnel, and smart factory automation specialists;
  - graduate electrical engineers to design chips and the tools and manufacturing processes that make the chips.
- The semiconductor sector will increasingly find itself **in competition with a variety of sectors**, such as tech companies and the automotive sector, for most of the skills targeted.
  - These sectors offer **higher levels of remuneration** than semiconductor companies.
  - And they often **require less time for study** than the semiconductor industry, which may discourage many students.
- Moreover, the industry suffers from a **lack of attractiveness** in comparison with these sectors, due to factors such as **the image** of the semiconductor sector, **working conditions, diversity** and **inclusion**.

AN OVERALL EUROPEAN STRATEGY BEGINNING TO TAKE SHAPE

- The need to focus on training and attracting talent has obviously been identified at European level, but not necessarily quantified at this stage.
- The European Union's strategy under the **Chips Act** presupposes a strong interweaving of skills centers, universities and private players.
- It will require a high level of coordination in the distribution of resources and specialties. The establishment of the **European Chips Skills 2030 Academy** is intended to meet this objective by :
  - Setting up an industry university network and resources to support training and reskilling in the industry,
  - Managing coordination with competence centers,
  - Launching initiatives to raise the industry's profile.
- As we can see, the **creation of competence centers** and the **distribution of roles** will be of crucial importance.

Two risks may arise at this stage:

- A risk of resources being spread too thinly across a number of micro-competence centers.
- A lengthy coordination phase, which could slow down Europe's ability to turn new investments to account.

CLEAR ADVANTAGES AT EUROPEAN LEVEL THAT NEED TO BE LEVERAGED

Europe benefits from a number of comparative advantages that it needs to capitalize on, and which it needs to communicate widely not only to the private sector, but also to foreign employees and students.

1. **Good level of training:** recognized curricula, ecosystems already in place
2. **Low headcount turnover:** European countries (particularly those where the microelectronics industry is currently based) enjoy a lower turnover rate than the US, India or China. This issue of staff turnover, and therefore employee retention, is key in a sector where practical experience appears to be key.
3. **Much lower wages than in the US:** salary costs for engineers are much lower in European countries than in the US (see the chart on the right),
4. **Less competition from GAFAM:** pressure from Big Tech is lower in Europe than in the US, which may make it easier to attract skills in the sector within the EU.

Comparison of the cost of a researcher (base 100 = US) - source : ANRT Index 2022	
India	21
Poland	**28**
Spain	**33**
Brazil	33
Italy	**41**
South Korea	41
China	41
France with R&D tax credit	**44**
Singapore	46
Japan	46
United Kingdom	49
Canada	54
Belgium	**55**
Germany	**59**
France without R&D tax credit	**61**
United States of America	**100**

THE RESPONSIBILITY OF COMPANIES ALSO APPEARS TO BE STRONGLY ENGAGED

- As we saw earlier, the attractiveness of semiconductor companies is a major issue on which a great deal of effort needs to be focused in the short/medium term, particularly in three areas:

Working conditions

It is imperative that companies in the sector take a proactive approach to the issue of working conditions and communicate on the subject **in order to counterbalance an unattractive image** in this area (e.g. working hours, work from home, paid family leave…)

Competitive salary conditions

Semiconductor companies are facing **increasingly head-on competition from sectors offering significantly higher levels of remuneration** for the same level of qualification.

- In this context, firms need to think about the **packages** they offer,
- The introduction or improvement of **value-sharing mechanisms** for the benefit of employees is a factor in attracting and retaining employees and lends credibility to the "joint project" often put forward by top management.

Values issues (diversity / ESG)

Companies in the sector need to pay particular attention to a number of aspects, as employees' expectations have changed significantly

- The question of **shared values** is essential to give meaning to work and joint effort.
- The issue of **diversity**, which is also a weak point in the sector (for example, according to GSA (Women in the semiconductor 2020), women will represent only 1% of leadership positions in 2020).
- **Environmental issues**, which need to be taken seriously in view of the sector's impact, particularly in terms of water use.

SEVERAL ACTIONS COULD HELP LIMIT RISKS IN THIS CRUCIAL FIELD FOR EUROPE

On the corporate side

- Effort on remuneration
- Build common values based on a shared corporate project
- Invest massively in employee training

From the public sector

- Set up training courses and communicate on the subject
- Clarify the question of the distribution of skills centers (heart of the EU's strategy)
- Attract skills from other geographical areas

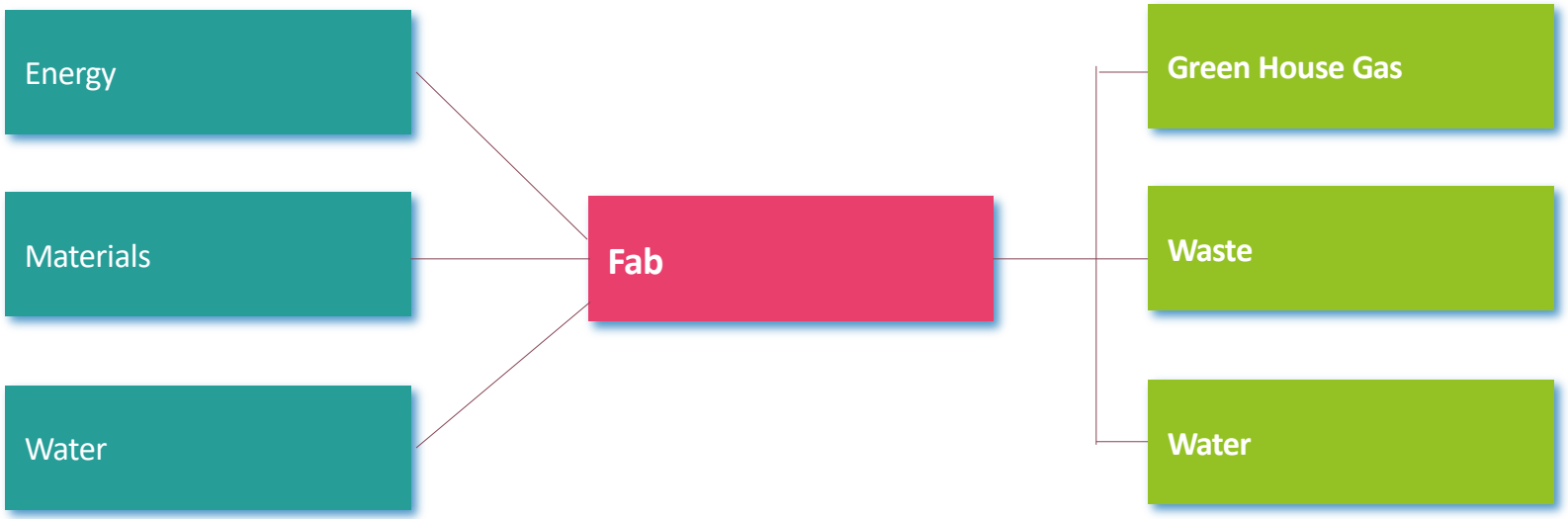
Joint actions

- Set up public/private funding schemes to finance studies.
- Rapidly define a clear public/private organization plan (EU, countries, regions, universities)

#6

SUSTAINABILITY AT STAKE

TO BE SUSTAINABLE, FABS NEED TO MINIMIZE GHG, WASTES AND WATER USAGE

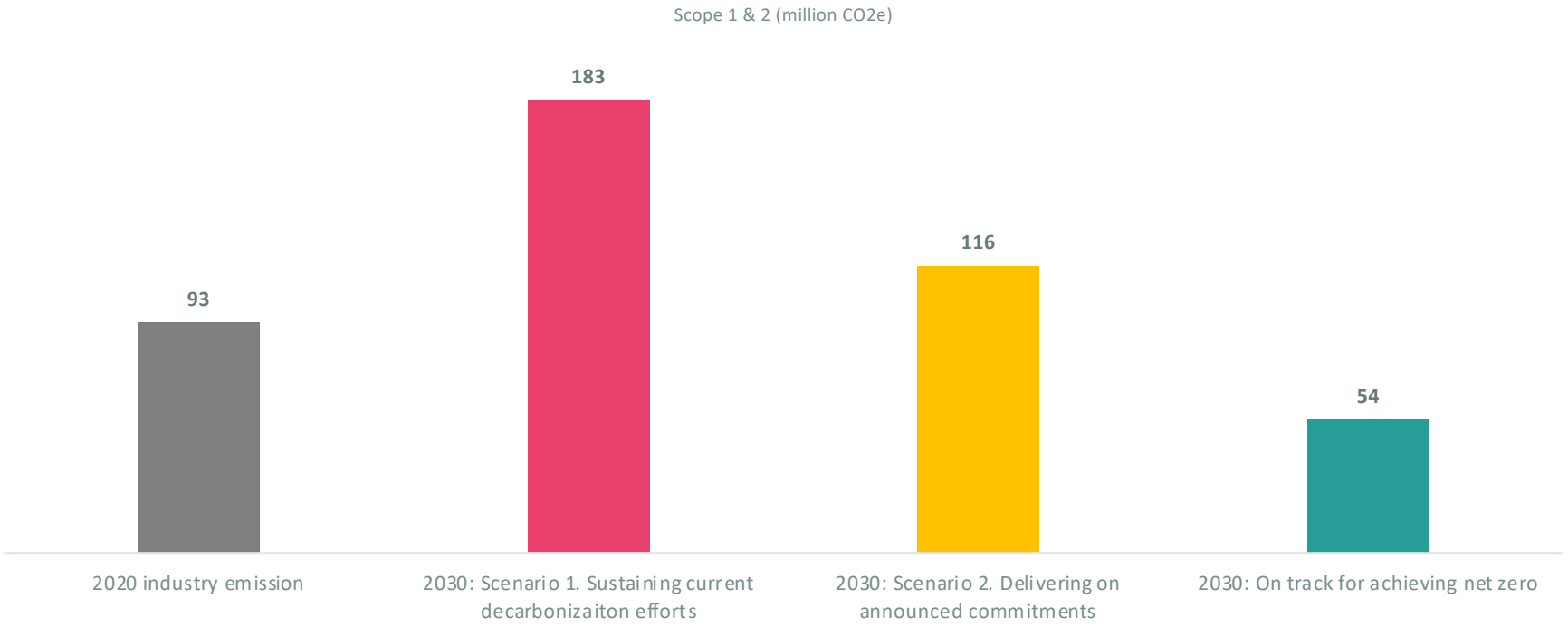


IT IS UNLIKELY FOR THE SEMICONDUCTOR INDUSTRY TO COMPLY TO THE 1,5° TRAJECTORY 1/3

- In November 2022, Mc Kinsey published an article “Keeping the semiconductor industry on the path to net zero ».
- According to Mc Kinsey, in a typical semiconductor fab,
  - 35% of emissions are classified in Scope 1;
  - 45% in Scope 2;
  - 30% in Scope 3.
- The split may be different from one fab to another.

- Scope 1: emissions coming directly from fabs
- Scope 2: purchased electricity, steam, heating, cooling
- Scope 3: transport & suppliers (raw material etc.)

IT IS UNLIKELY FOR THE SEMICONDUCTOR INDUSTRY TO COMPLY TO THE 1,5° TRAJECTORY 2/3



- Scenario 2: assuming companies will commit to what they have announced.
- Scenario 3: assuming a 4,2% reduction per year between 2020-2023.

IT IS UNLIKELY FOR THE SEMICONDUCTOR INDUSTRY TO COMPLY TO THE 1,5° TRAJECTORY 2/3

- According to 3 scenarios elaborated by Mc Kinsey, only a very ambitious scenario would allow the sector to comply to a 1,5° trajectory by 2030 (for Scope 1 & 2).
  - It would mean a decrease of the carbon dioxide equivalent CO_2e compared to 2020. This would require much more radical measures than the ones announced by the industry.
- In a conservative scenario, CO_2e would almost double from 2020 to 2030. This has lot to do with the forecasted dynamic increase of production.
  - This is based on the current announcements of the semiconductor's players.
- In a more ambitious scenario that would limit the rise of CO_2e, some of the players would need to strengthen their plan.

SEMICONDUCTOR COMPANIES ARE PUBLISHING COMMITMENTS THAT ARE HETEROGENEOUS AND HARD TO FOLLOW 1/2

	Goal	Progress by YE 2022
Texas Instrument		
Green House Emissions	By Year-end 2025 25% reductions in absolute scope 1 and scope 2 emissions from a 2015 base year	23% reduction in GHG emissions
Energy	50% in reduction intensity per chip from a 2015 base year	28% in reduction intensity per chip
Water	3,4% equivalent of total water usage in 2022	3,2% reduction in water use
Waste and material management	in 2022, divert 90% of solid waste materials generated from landfills	90% materials diverted from landfills

	Goal	Progress by YE 2022
ST Microelectronics		
Green House Emissions	Carbon neutrality by 2027	-40% scope 1 & 2 since 2018
Energy	Sourcing of 100% renewable energy by 2027	Energy consumption decrease by 19,8% vs. 2016 per unit of production
Water	Improve water efficiency by 20% by 2025 vs. 2016 Recycle at least 50% of the water used every year	-12% in 2022 42% in 2022
Waste	Reuse or recycle 95% of our waste by 2025	95%%

Source: 2022 Texas Instrument Corporate Citizenship report. 2022 STM Sustainability report

SEMICONDUCTOR COMPANIES ARE PUBLISHING COMMITMENTS THAT ARE HETEROGENEOUS AND HARD TO FOLLOW 2/2

	Goal	Progress by YE 2022
NXP		
Green House Emissions	Carbon neutral by 2035 Reduce carbon emissions by 35% in 2027 (2021 baseline)	-1% Scope 1 and 2 emissions compared to 2021
Energy	50% renewable electricity by 2027	35% of renewable energy: +4 point vs 2021
Water	60% of wastewater recycled by 2027	Wastewater recycled by 48%: 1 point vs 2021
Waste	90% of waste recycled by 2027	Waste recycled by 83%: + 7 points vs. 2021

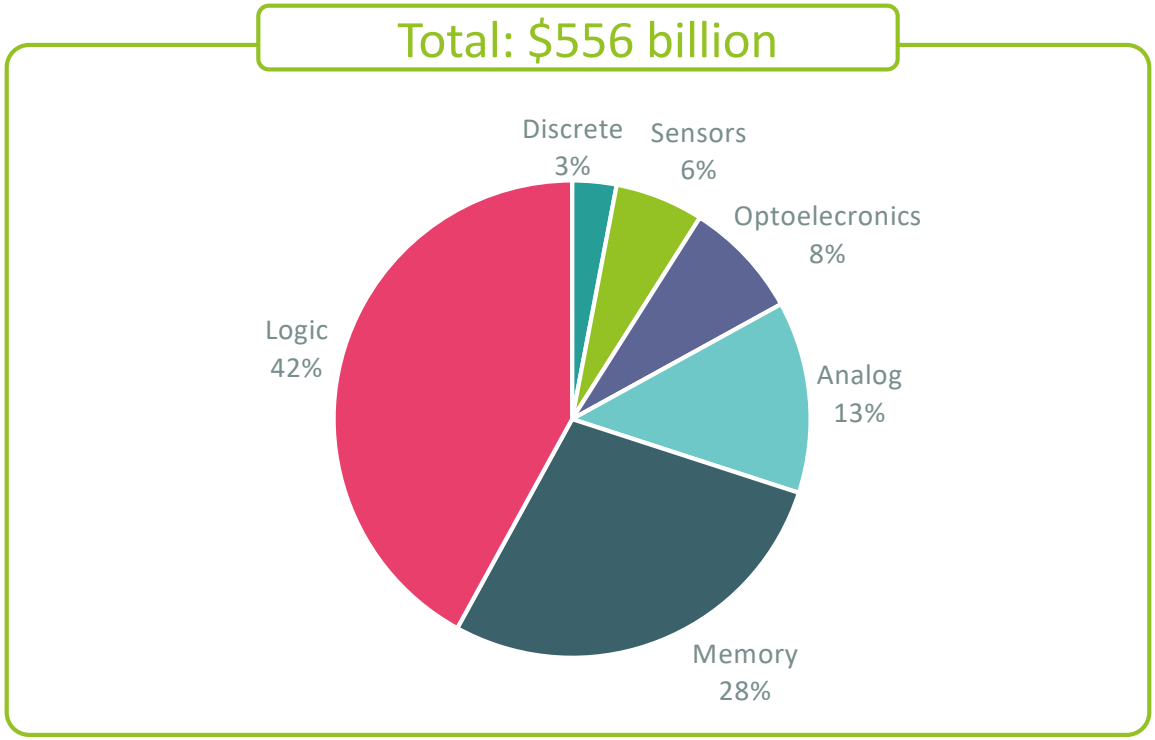
	Goal	Progress by YE 2022
Qualcomm		
Green House Emissions	Reduce absolute Scope 1 and 2 GHG emissions by 30% by 2025 vs. 2014 baseline Reduce absolute Scope 1 and 2 GHG emissions by 50% by 2030 vs. 2010 baseline Reduce absolute Scope 3 GHG emissions by 25% by 2025 vs. 2020 baseline Reach Net-zero global GHG emissions for Scopes 1 & 2 and 3 by 2024	28% in 2022 compared to 2014

Source: NXP 2022 Corporate Sustainability report. Qualcomm 2022 Corporate Sustainability report

#7

EU, TECHNOLOGY AND INVESTMENTS: IS THE 20% TARGET REALISTIC?

SEMICONDUCTOR SALES 2021 (TOTAL 556 $BN)



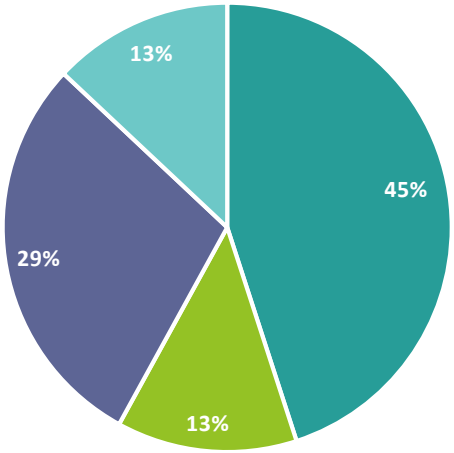
Source: CRS, adapted from Semiconductor Industry Association, *2022 Factbook*, May 2022, p. 12.

- Logic (42%) and Memory (28%) represent 70% of the market.
- This is where Samsung and Hynix (and Micron for the DRAM) dominate the market.

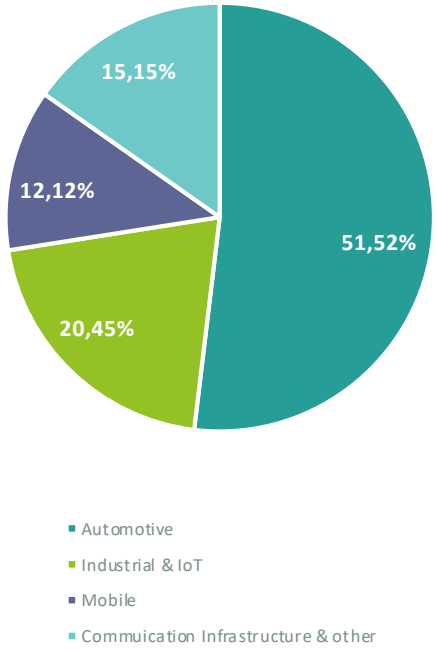
EUROPEAN PLAYERS ARE MOSTLY ON AUTOMOTIVE AND INDUSTRIAL MARKETS

The 3 biggest European companies are mostly dedicated to a small part of the market. They are not addressing 70% of the overall market.

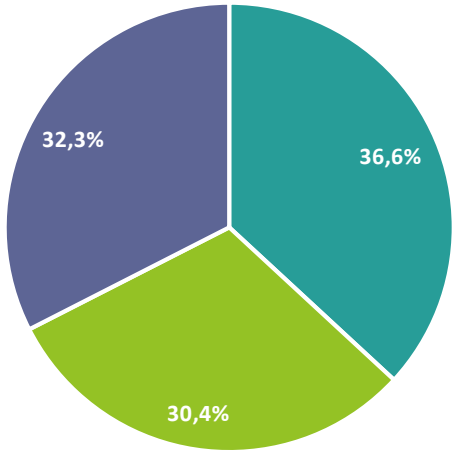
Infineon split of € 14bn revenue (2022)



NXP split of €13 bn revenue (2022)



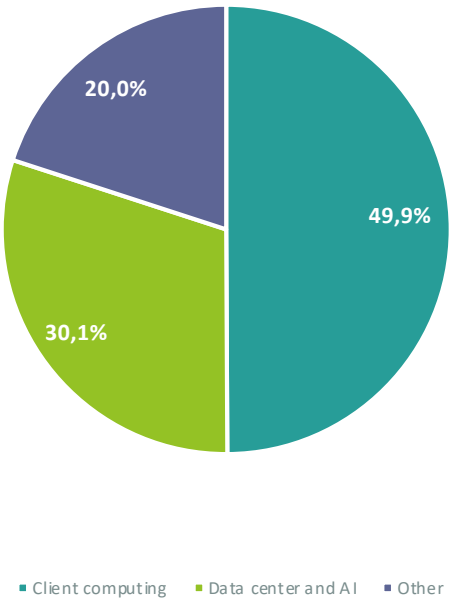
STM split of $16,3 bn revenue (2022)



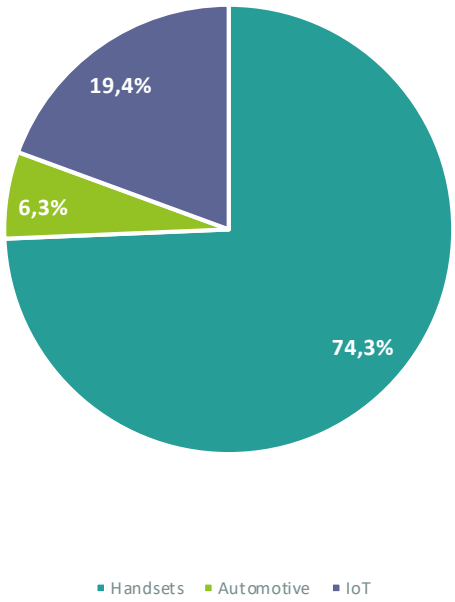
US COMPANIES ARE MOSTLY ON COMPUTING, DC AND TELECOM (MASS MARKETS)

These 3 American players generate only a marginal portion of their revenue in the industrial/automotive markets.

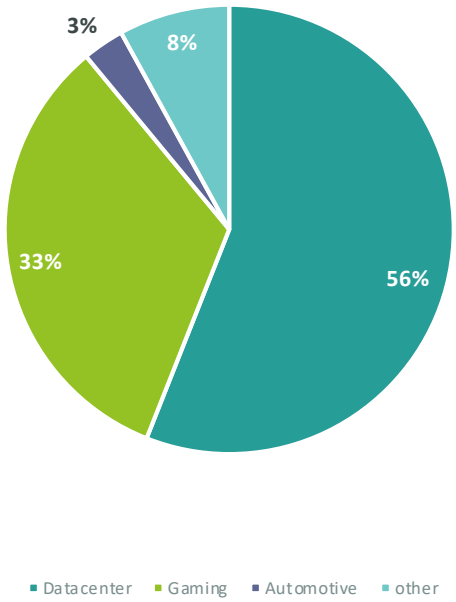
Intel split of $63 bn revenue (2022)



Qualcomm split of $44 bn revenue (2022)



Nvidia split of $26 bn revenue (2022)



EU WILL NOT GET 20% OF THE MARKET IN 2030 1/2

- 70% of the semiconductor market is composed memories and processors for PCs, laptops and servers, powering the AI revolution, with the most advanced engraving technologies in FinFet down to 2 nanos tomorrow.
- The memory business is predominantly in Asia (South Korea, Japan).
- The semiconductor foundries are predominantly in Taiwan with TSMC.

EU WILL NOT GET 20% OF THE MARKET IN 2030 2/2

- 30% of semiconductors are technologies mastered by Europeans: mixed-analog, power, sensors.
- European leaders are STMicroelectronics, Infineon and NXP. Bosch might be added due to its investments in the sector.
- Europe is present only through:
  - its Leti and IMEC laboratories ;
  - ASML's FinFet etching machines, Siemens CAD ;
  - an Intel fab in Ireland ;
  - and the key architect ARM from the UK (owned by Softbank).
- To achieve 20% of global semiconductor manufacturing in Europe we would need :
  - to capture more than 70% of the analog/sensors/discrete market
  - or invest heavily in memory and processors
- **The EU is a far away from achieving its stated objective**

CONCLUSION

TOO LITTLE TOO LATE?

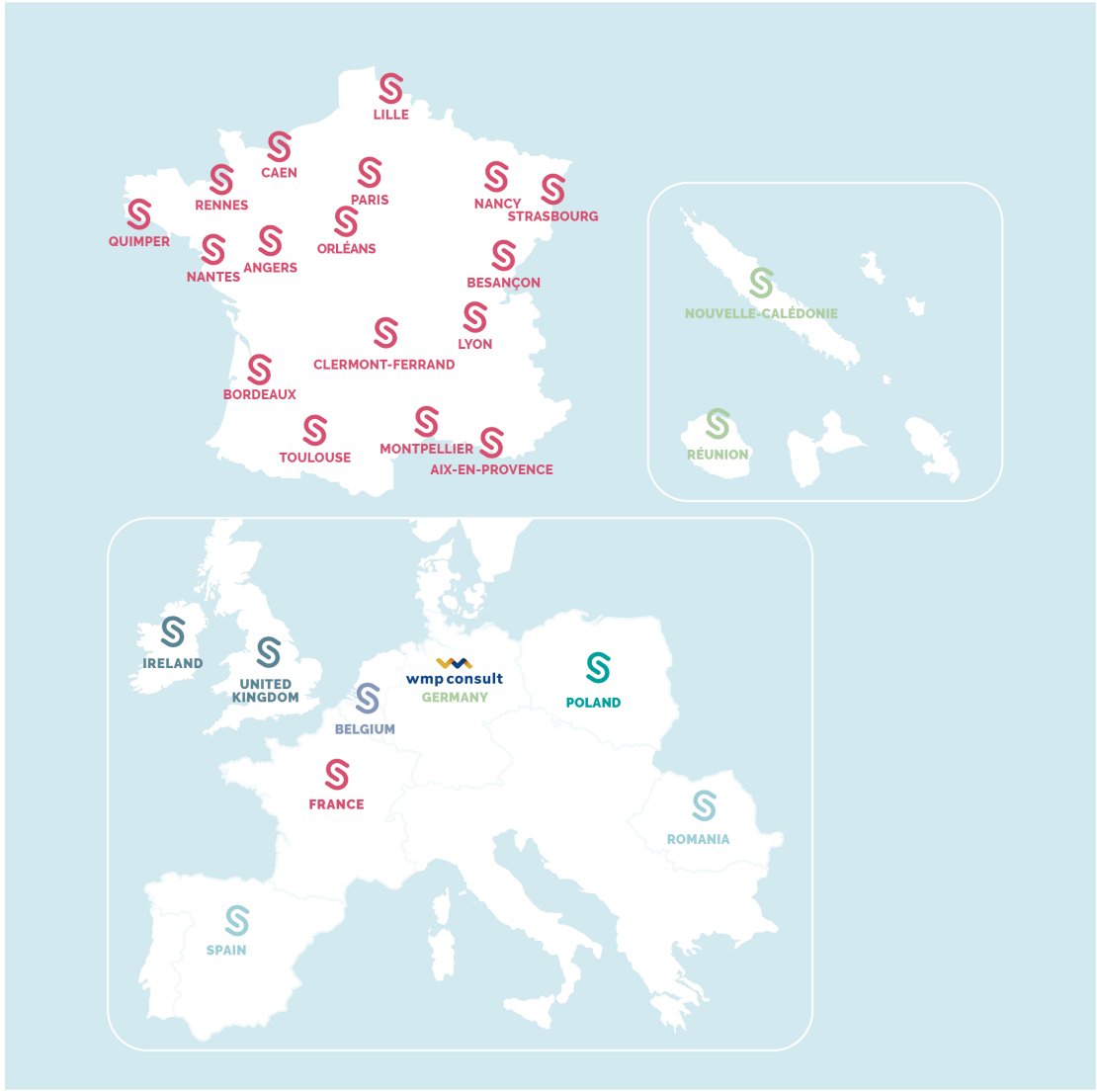
- Europe is lagging begind
- Tech giants are not European

- EU support is not important compared to other countries that try to attract investments

- European top players are only targeting 30% of the market

- More than $ 300 bn investments announced in the US
- Around € 100 bn in Europe

- The EU will not reach its target in 2030



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KNOWLEDGE FOR ACTION

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