MICROELECTRONICS IN GERMANY AND EUROPE – TRENDS AND PERSPECTIVES

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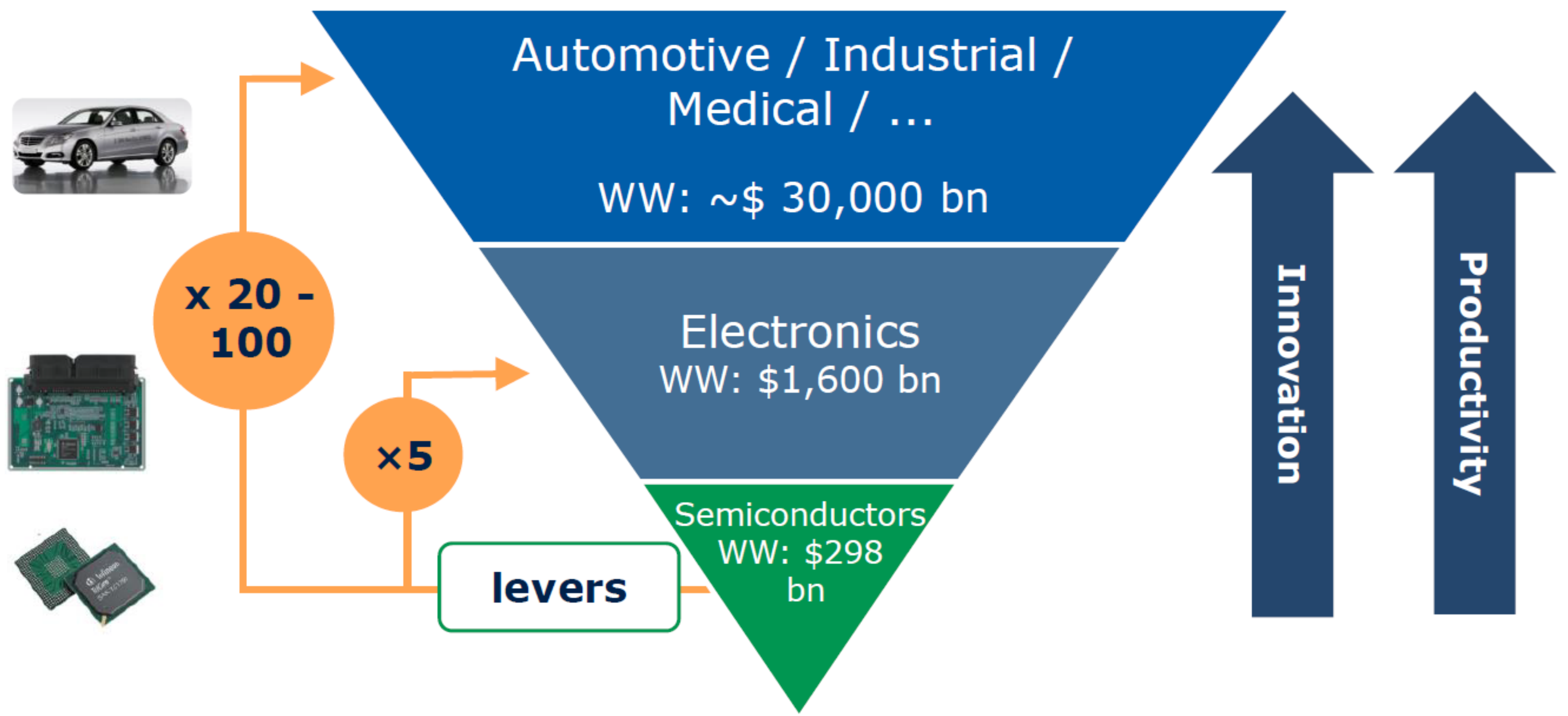
Semiconductors – a Driver for Innovation



About 45% of the OECD Economic growth since 1985 comes from increased productivity; electronics is a key driver for this growth. Up to 80% of innovation in automotive is enabled by semiconductors, even more when it comes to Hybrid and EV.

- Source: DECISION, ESIA, Future Horizons, IMF, WSTS 2010, AUDI, OECD Factbook 2013

Technology Trend 2020 – Will Moore's Law come to an End?

- Business drivers
  - in the 70s:
    component industry – need for cost effective memories & ASICs
  - in the 80s:
    system integrators – technology driven by memory devices and adopted by logic
  - In the 90s:
    IC manufacturers – technology development accelerated by logic
  - Today:
    system integrators –
    complexity – systems on chip (SOC) – systems in package (SIP) – More-than-Moore

source: ITRS 2013

Technology Trend 2020 – Will Moore's Law come to an End?

Situation today:

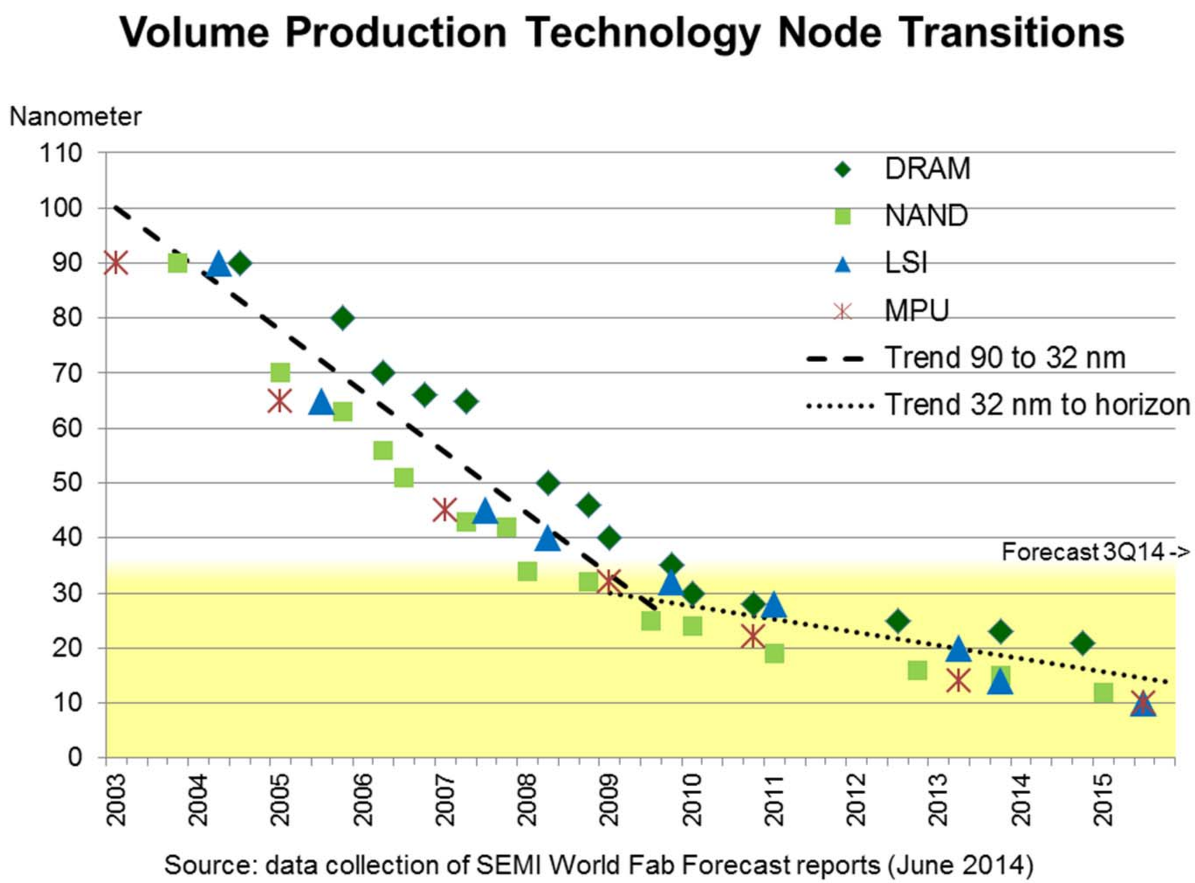
- Devices
  - 2D Scaling will reach its fundamental limits
  - „Functional scaling"– the new scaling paradigm
  - Upcoming new (non CMOS) devices

- System Integration
  - Driven by mobile devices
  - 3D heterogeneous integration
  - Merge of „More Moore" with „More-than-Moore"

- Manufacturing
  - The 450mm Challenge – postponed
  - Scaling – slowing down
  - Costs – increasing again!

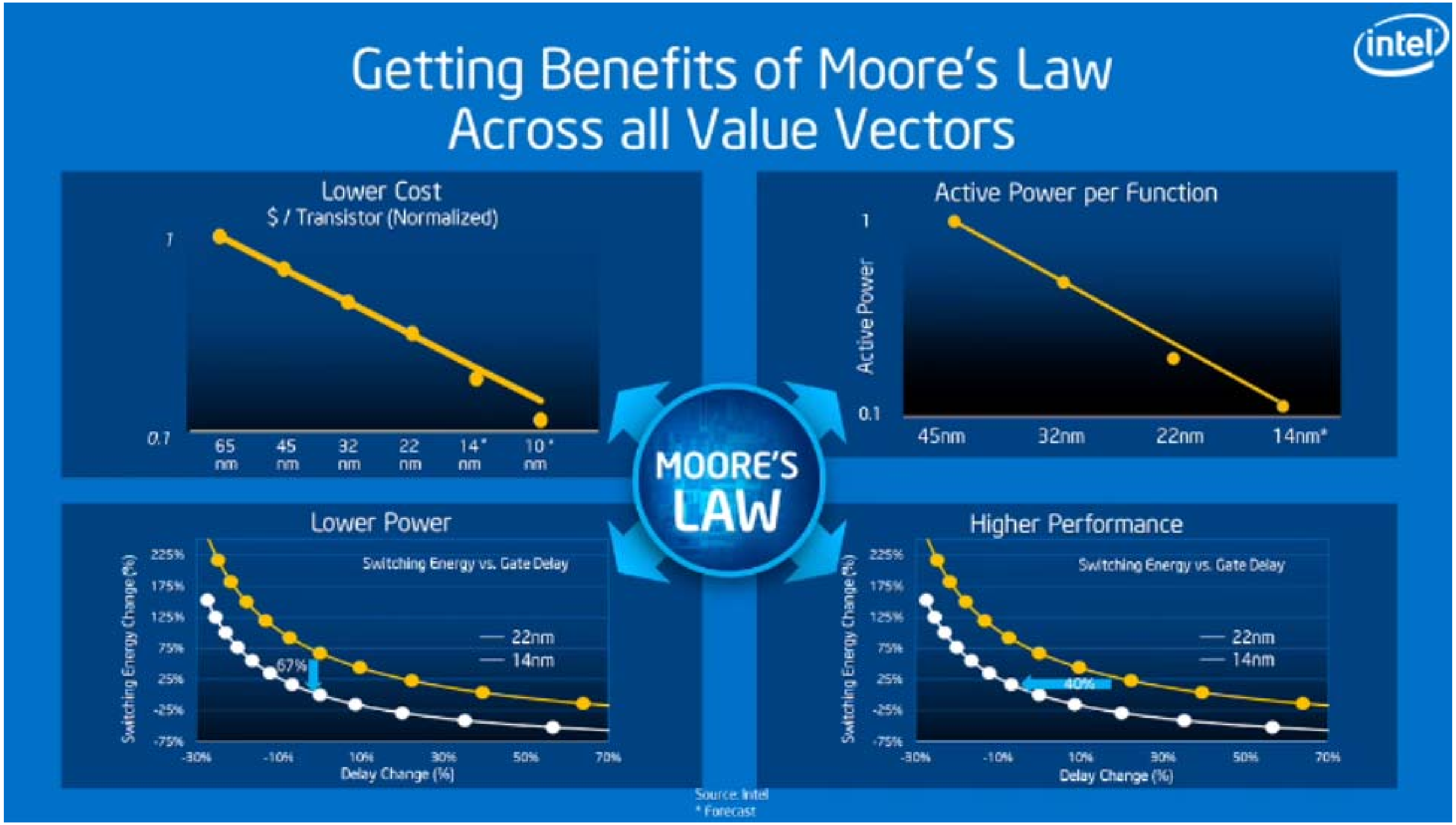
source: ITRS 2013

Technology Trend 2020 – Will Moore's Law come to an End?



Source: Semi Europe 2014

Technology Trend 2020 – Will Moore's Law come to an End?



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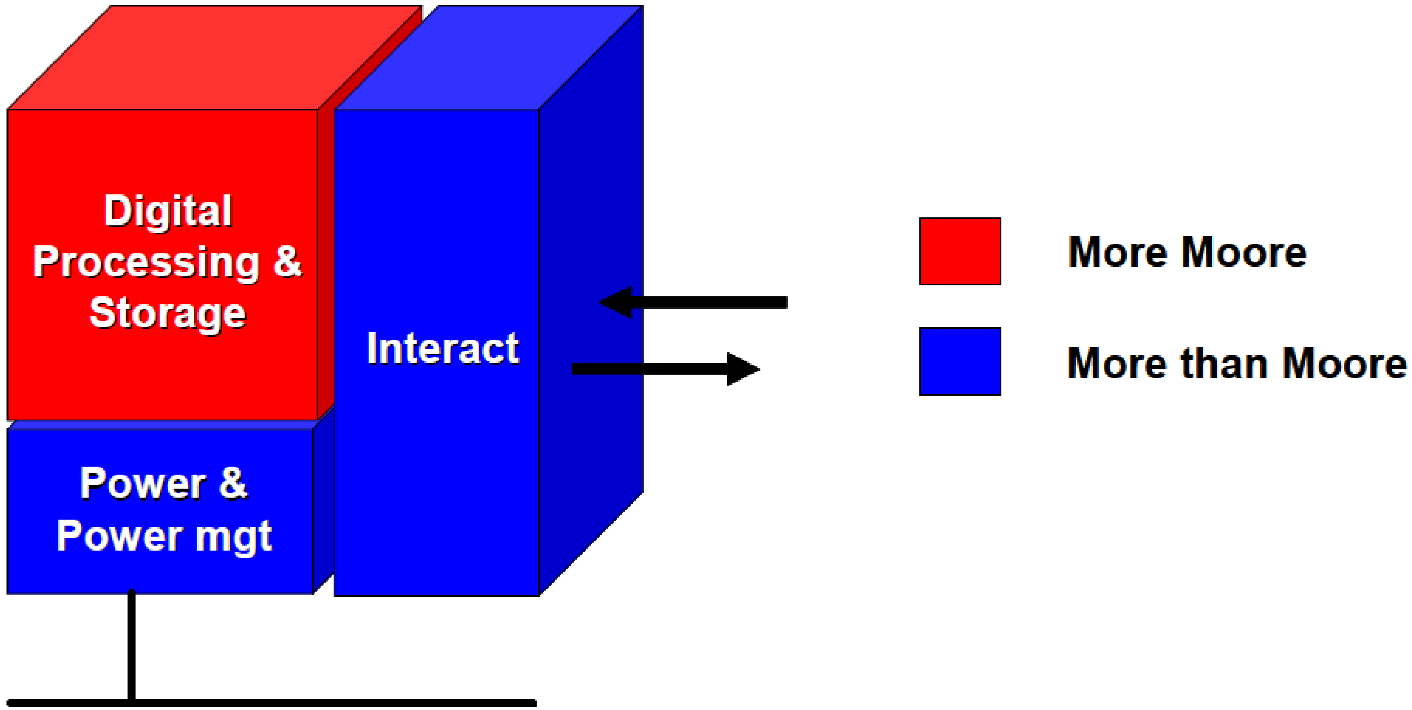
More than Moore Technologies



„More than Moore“ technologies complement the digital processing and storage elements of an integrated system in allowing the interaction with the outside world and in powering the system.

Source: CATRENE Scientific Committee, Editor Michel Brillouet: Towards a “ More-than- Moore Roadmap“ November 8,2011

Technology Trend 2020 – The Merge of More Moore & More than Moore

Grand Challenges will need **Smart Integrated Systems** at the end of the day

- Europe is leading in Diversification, but Miniaturization has gone to Far East
- Smart Integrated Systems is the smart combination of both

Therefore, Smart Integrated Systems require up-to-date technology for both worlds: »More More« as well as »More-than-Moore«

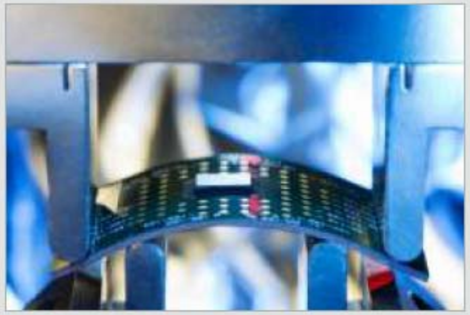
Technology Trends in Smart Systems

Multi-functionality

System Reliability

Smart Systems

Application oriented Packaging



Ultra Low Cost

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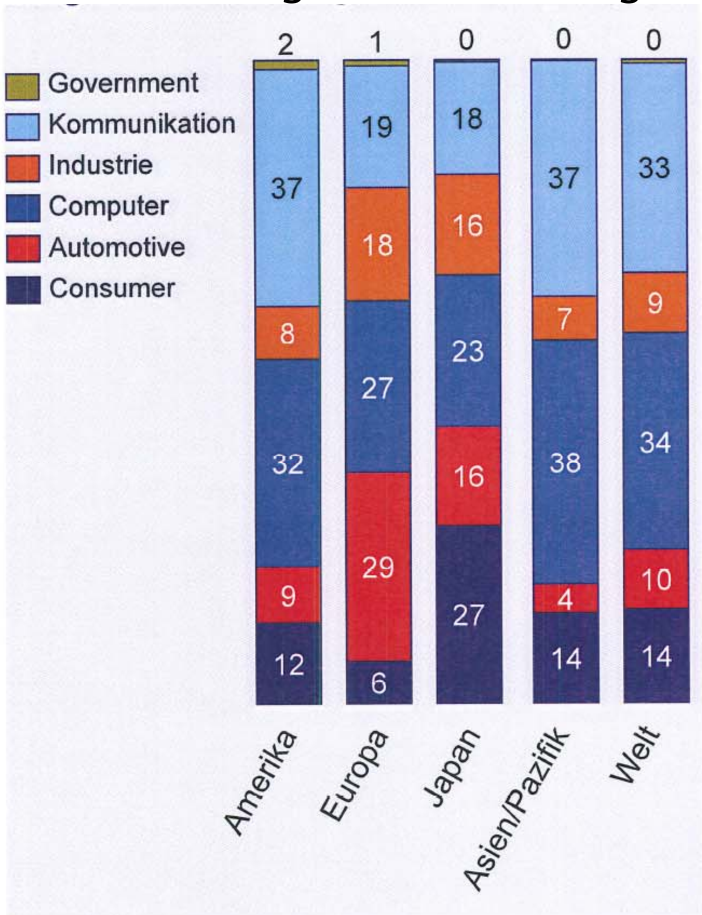
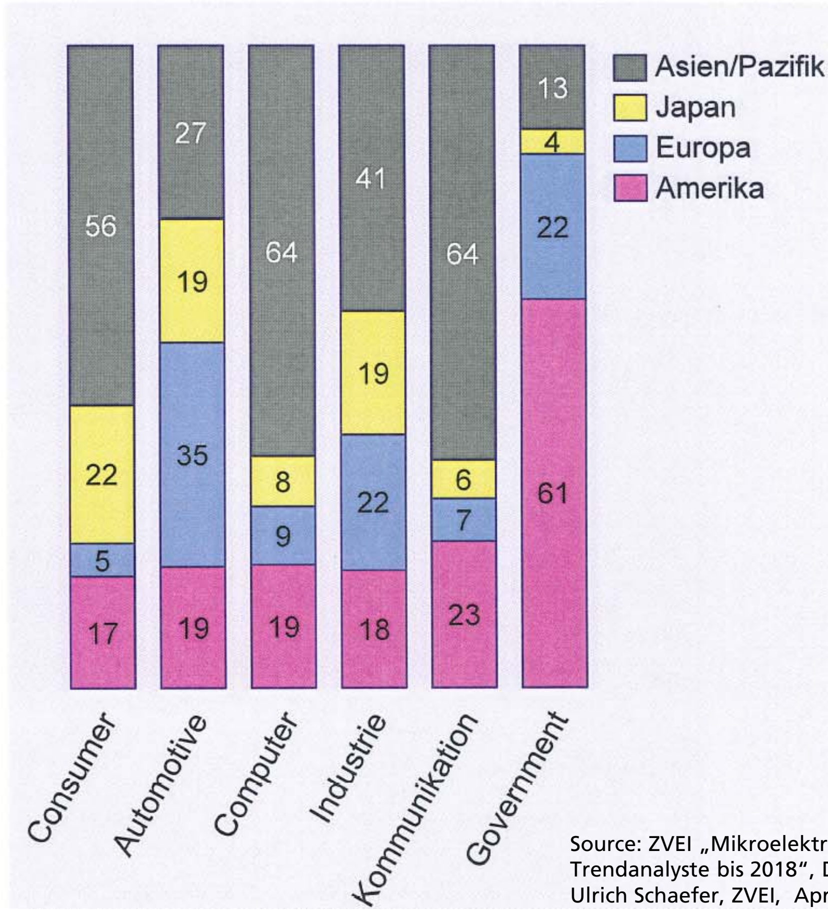
Semiconductor Market Segments by Regions - Status as of 2013 and regional Distribution

Distribution of Segments in the Regions



Regional Segment Distribution



Source: ZVEI „Mikroelektronik - Trendanalyste bis 2018“, Dr. Ulrich Schaefer, ZVEI, April 2014

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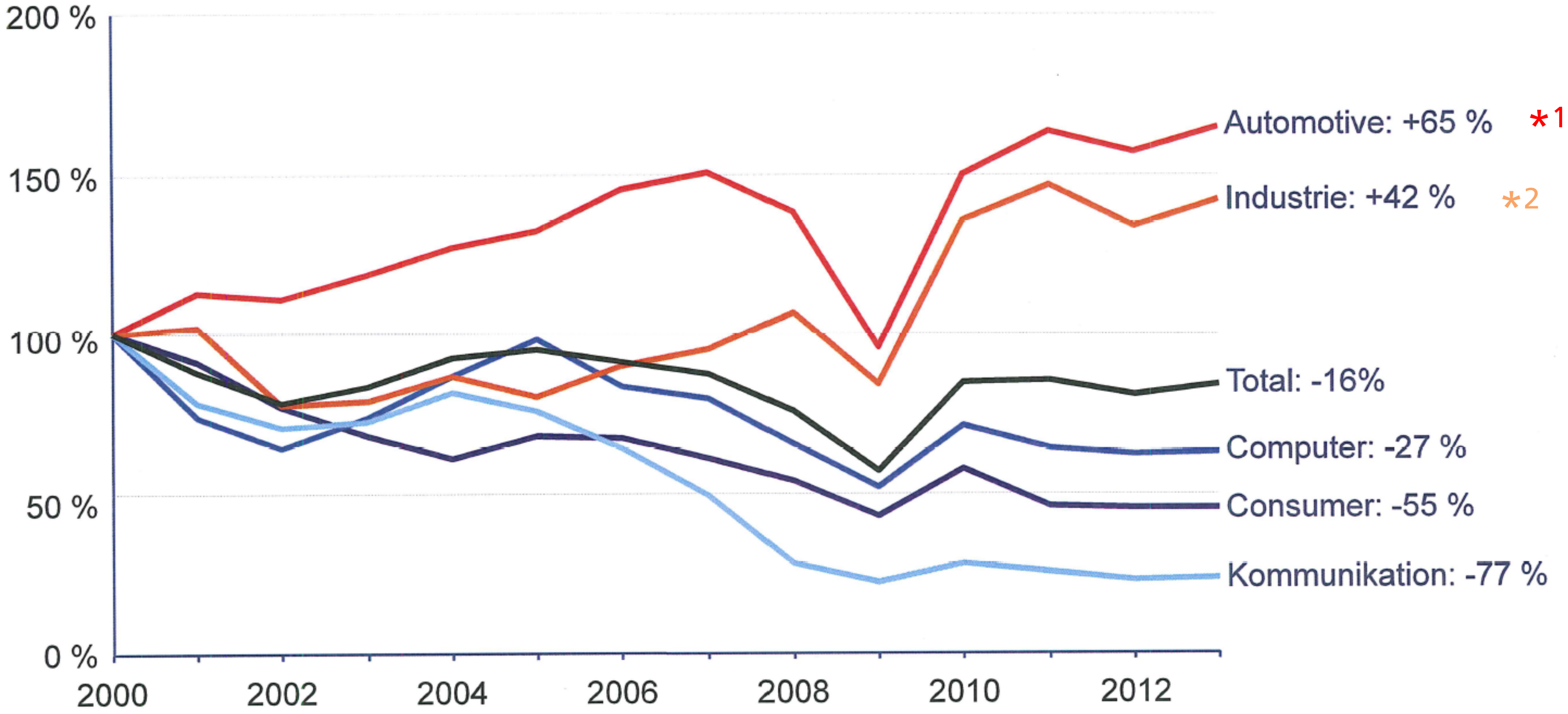
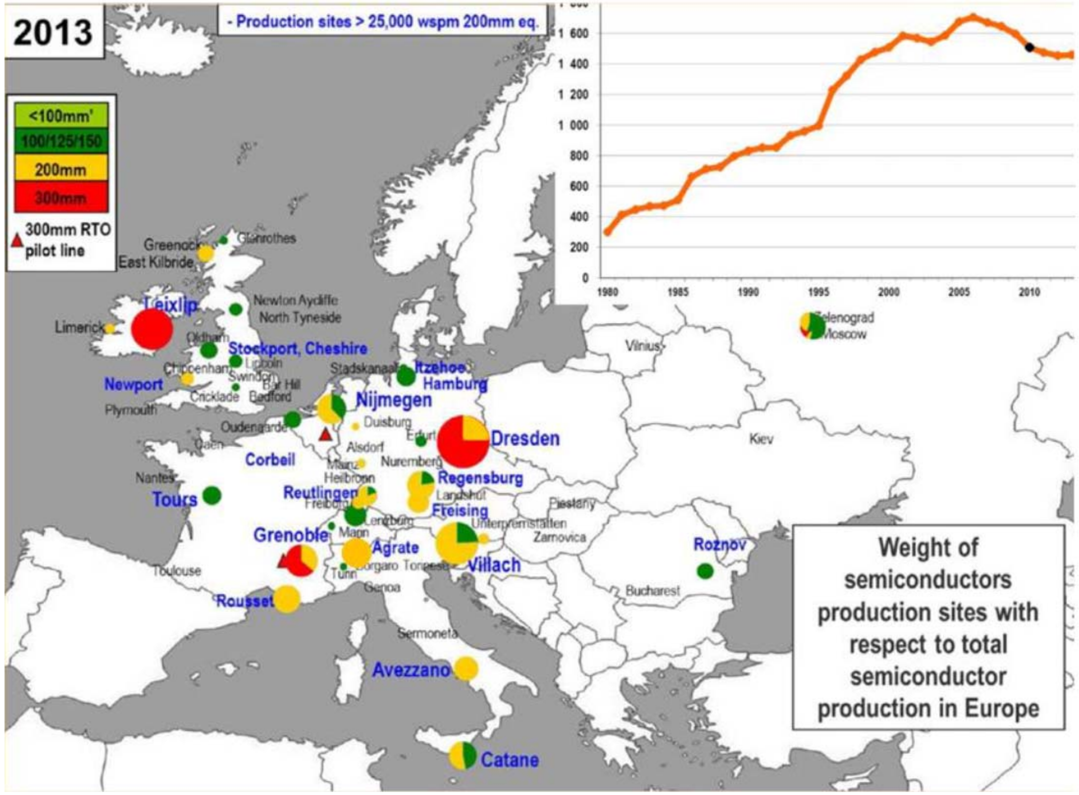
Market Segments for Semiconductor Industries in Germany – Development 2000-2013



*1 worldwide growth: 145 %   *2 worldwide growth: 86 %

Source: ZVEI „Mikroelektronik - Trendanalyste bis 2018“, Dr. Ulrich Schaefer, ZVEI, April 2014

Semiconductor Manufacturing Landscape in Europe 2013



Source inset "Evolution of semiconductor manufacturing landscape in Europe from 1980 to 2013": Gartner, Yole, SEMI

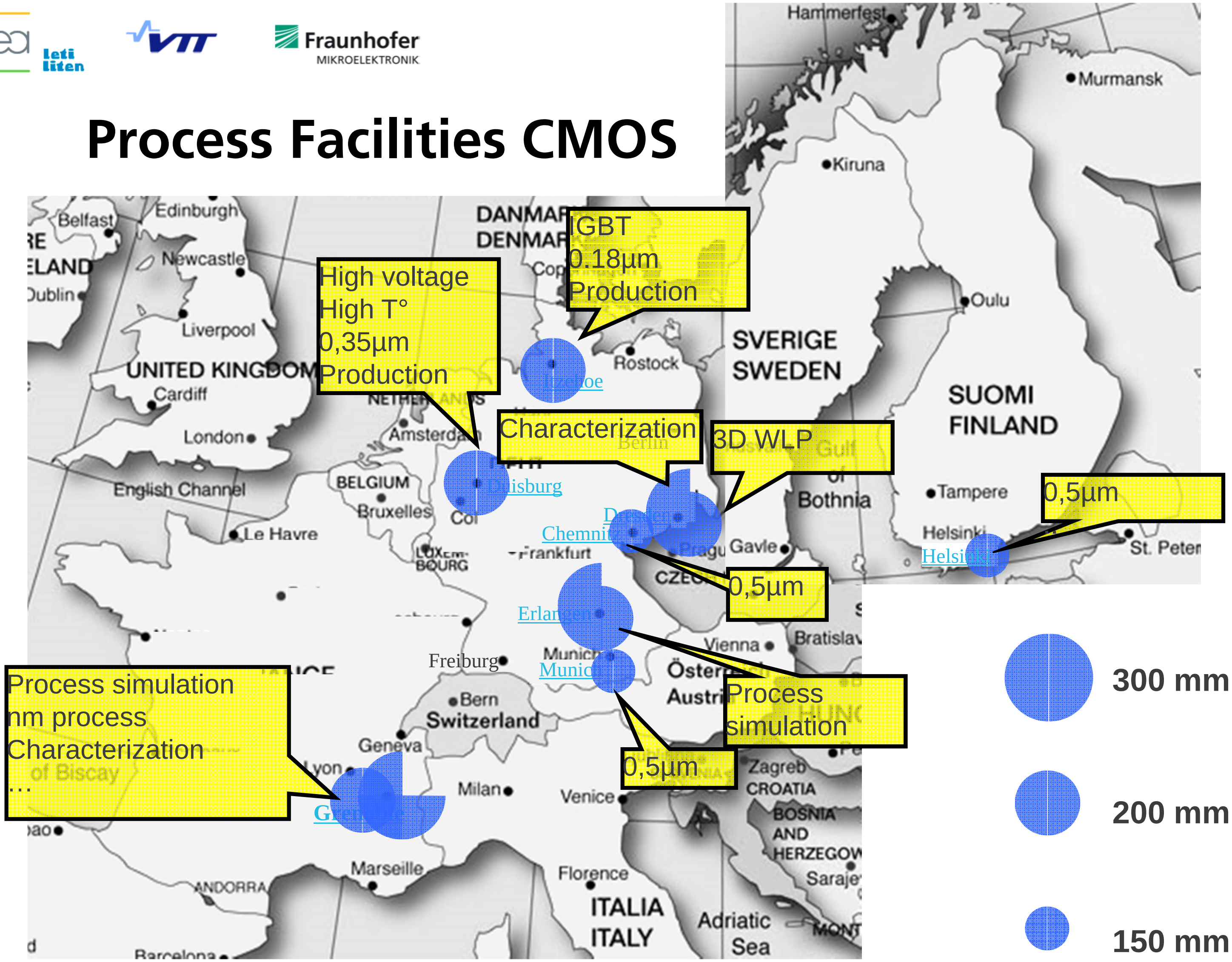
- Semiconductor manufacturing in Europe is based in a large number of sites,
- high volume manufacturing of leading edge technologies is centred on a few clusters
- annual output in equivalent 200 mm wafer starts per month in europe for the last three decades is shown. The figure shows a steady growth over two decades, but output peaked in 2005 and is now in decline.

Source "A European Industrial Strategic Roadmap for Micro- and Nano-Electronic and Components", a report to vice president Kroes by the electronic leaders group, 30th January 2014

The Heterogeneous Technology Alliance HTA

csem   cea leti liten   VTT   Fraunhofer MIKROELEKTRONIK

Process Facilities CMOS



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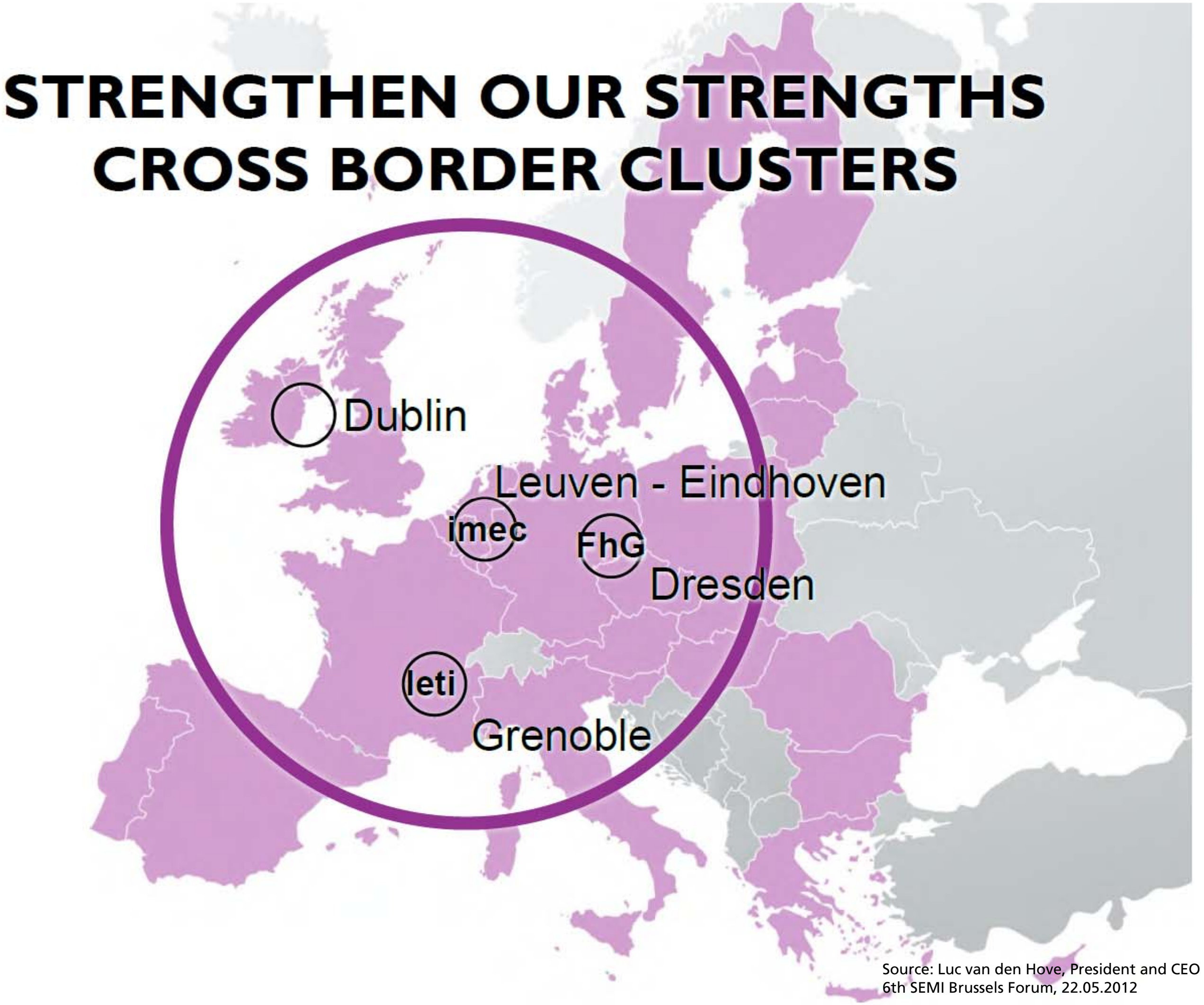
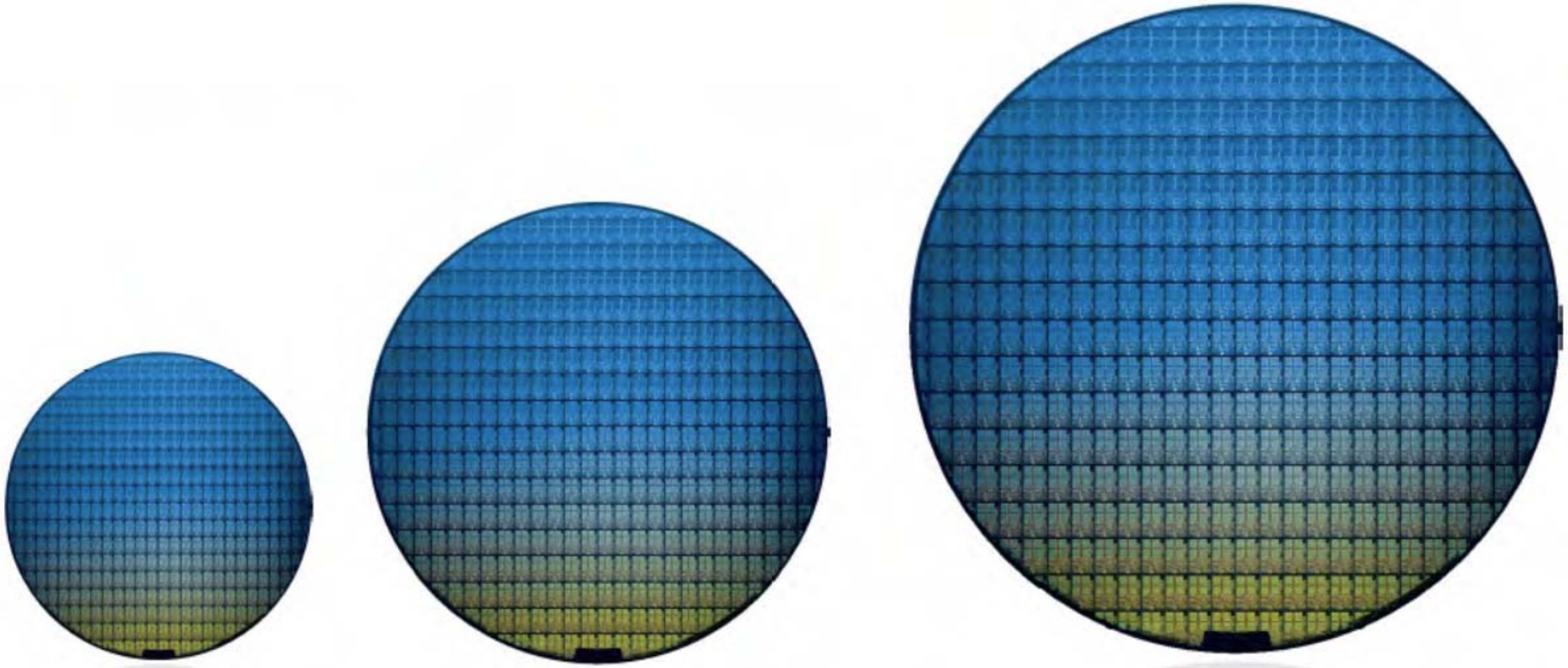
Cross Border Clusters



Source: Luc van den Hove, President and CEO IMEC,
6th SEMI Brussels Forum, 22.05.2012

Transition to 450 mm Wafers



200 mm	300 mm	450 mm
Pilot Lines for R&D	Pilot Lines for advanced R&D	Pilot Lines for advanced R&D and Support to E&M
More than Moore	**More Moore**	
	More than Moore	**More Moore**

Source: Luc van den Hove, President and CEO IMEC, 6th SEMI Brussels Forum, 22.05.2012

Disruptive Semiconductor enables Smart Innovation

Best user experience

- Smart applications
- Real-time device-specific info
- Access to more services (health statistics, social media)

Smarter connected objects

- Higher data rate
- Faster processors
- Longer battery life time

Smarter devices

- Ubiquitous connection
- Faster devices
- Longer battery life time

Smarter substrates

- Unique expertise in engineered materials
- Innovative proprietary technologies

semi

Source: Auberton-Herve, SOITEC