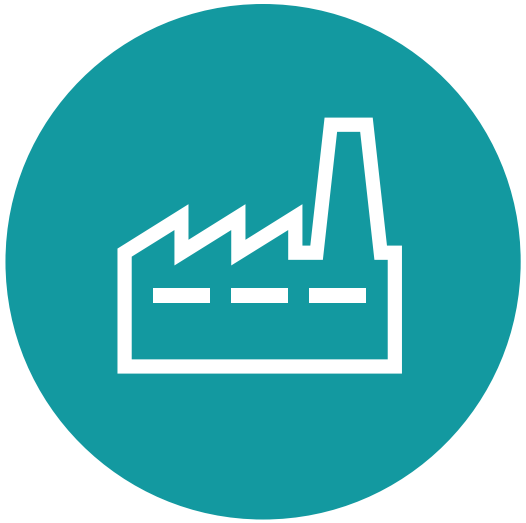
IPCEI on Microelectronics - a strong European Microelectronics industry for the digital future in Europe

Jens Fabrowsky,

Executive Vice President Automotive Electronics
Robert Bosch GmbH

Bosch – Four business sectors

Mobility Solutions



Industrial Technology

Energy & Building Technology

Consumer Goods

„The products behind the products“

Semiconductor components

MEMS Sensors

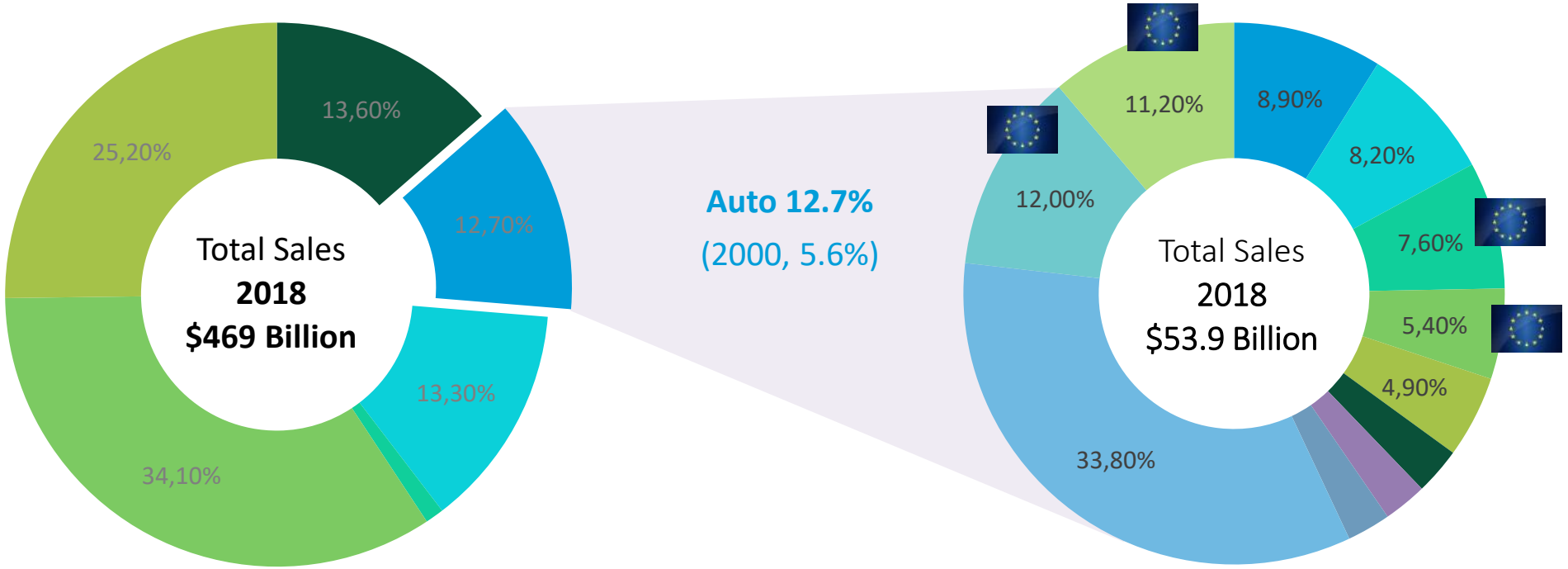
- **Acceleration / angular rate sensors**
  For airbag systems, driver information, vehicle dynamics systems, active suspension systems, consumer devices
- **Optical microsystems**
  For consumer devices, IoT applications, home appliances, head-up displays
- **Pressure Sensors**
  For airbag systems, engine management systems, transmission control systems, consumer devices, IoT solutions

Semiconductors

- **SoCs, system ASICs and sensor ASICs**
  For specific automotive applications
- **Power semiconductors and modules**
  Low voltage power semiconductors for various automotive applications and robust high voltage power modules for electric powertrain inverters
- **IP modules for µC integration**
  Individual functions, developed in Reutlingen for licensing

Trends and Challenges

Distribution of Total Semiconductor Production 2018 and Vendor Ranking of Automotive Semiconductors * 2018



* incl. MEMS Sensors

Source: Strategy Analytics, WSTS, Bosch

Microelectronics are a key technology for meeting challenges of the application domains in a CO2 neutral and digital society

Application

- Power Smart Grid
- Transport & Mobility
- Smart Home Smart Cities
- Industry 4.0
- IoT
- Health

Requirements

CO2 neutral · Always connected · Ubiquitous sensing · Edge intelligence · Extreme reliability · high power density · energy efficiency · Security

Electronic Products

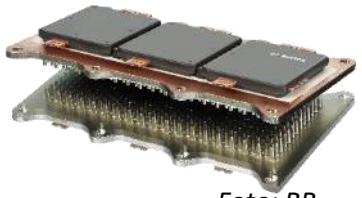


Foto: RB

Power electronics

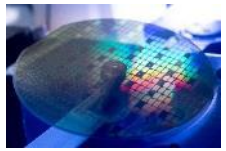
System on Chip

Embedded computing

Security modules

Sensors

Semiconductor Technology and Production



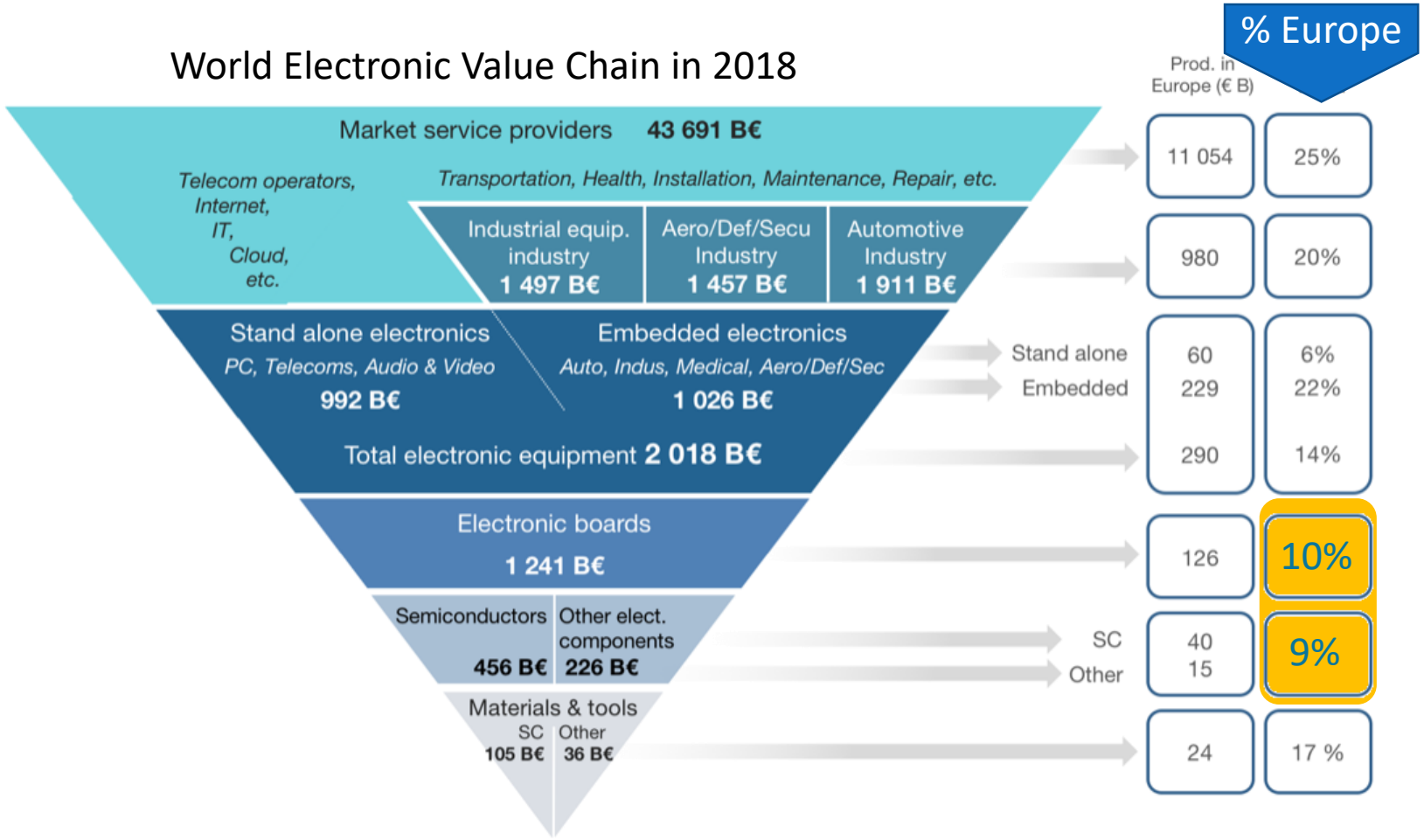
Materials, Technologies

Equipment

Production and Supply Chain

Semiconductors are the basis for European value chains

World Electronic Value Chain in 2018



European strengths (examples)

Vehicles, Industry, Medical Equipment

Automotive systems, Medical, Industry

SoC, smart power, sensors, security, µC

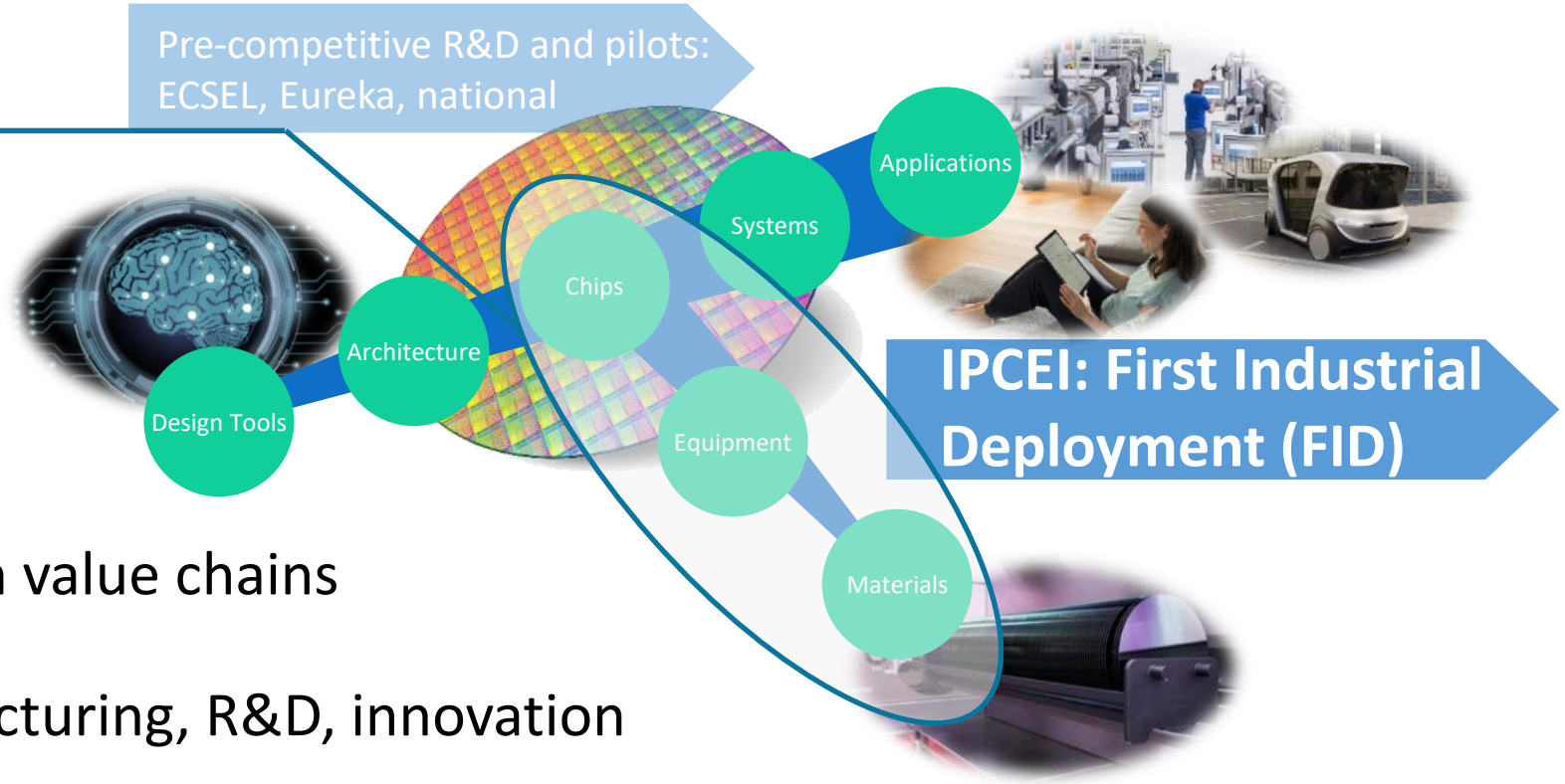
Manufacturing mixed signal >22nm, Special (MEMS, SiC, Power)

Tools, Lithography, Automation,

Source : DECISION for the study: Emerging Technologies in Electronic Components and Systems - Opportunities Ahead (DG CONNECT, 2019)

IPCEI goes the step to First Industrial Deployment (FID)

IPCEI 2017 – 2020 (2022)



Objectives

- Global Competitiveness
- Enabling strategic European value chains
- Strong, sustainable manufacturing, R&D, innovation
- Trustability and Sovereignty

Sources: Bosch, depositphotos

IPCEI on Microelectronics

Project management

1 Energy efficient chips	2 Power semiconductors	3 Sensors	4 Advanced optical equipment	5 Compound materials
CEA-Leti	3-D Micromac	CEA-Leti	AMTC	AZUR Space Solar Power
Cologne Chip	AP&S International	*CorTec*	Carl Zeiss*	CEA-Leti
Globalfoundries	CEA-Leti	Elmos Semiconductors		Integrated Compound Semiconductors
RacyICs	Elmos Semiconductors	Fondazione Bruno Kessler		IQE*
Soitec*	Infineon*	Infineon		Newport Wafer Fab
ST Micro-electronics	MURATA	Robert Bosch*		SPTS Technologies
X-FAB	Robert Bosch	ST Micro-electronics		OSRAM
	SEMIKRON	TDK-Micronas		Sofradir
	ST Micro-electronics	ULIS		Soitec
	X-FAB	X-FAB		ST Micro-electronics

* Coordinator
Name in "*italic*" = SME

Dissemination and communication

- 01.2017-12.2020/2022
- Balanced FID and R&D
- Significant Spillover Measures
- National Funding

Ministero dello Sviluppo Economico

Supported by:
Federal Ministry for Economic Affairs and Energy
on the basis of a decision by the German Bundestag

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
Le Gouvernement
and the local public authorities

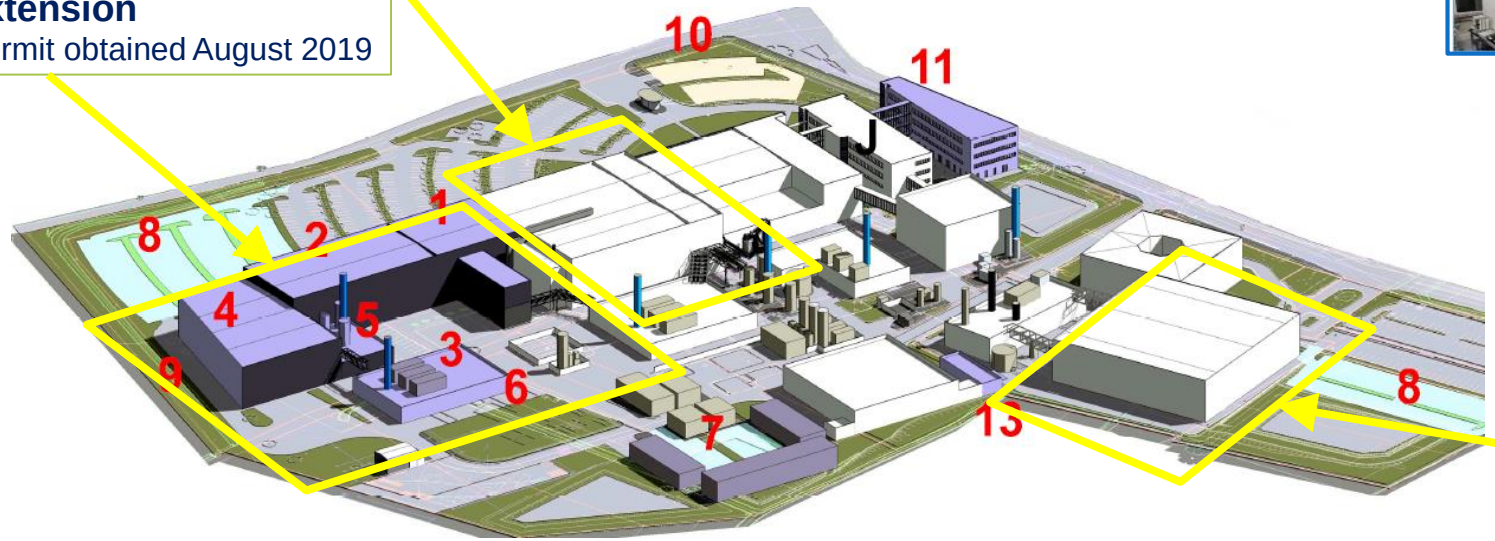
Source: ipcei-me.eu

IPCEI 2019 Outcomes and Perspectives

« Bernin 2 conversion »
300mm SOI substrates «new generation»

« Substrate Innovation Center »
R&D SOI fabrication line in Leti

« 5G » 300mm SOI Capacity Extension
2000m² Building Permit obtained August 2019



Le Leti et Soitec lancent un centre d'innovation pour développer les substrats

12/07/2018 [IIT, ACCORD, FRANCE, R&D, SEMICONDUCTEUR]
Tags: Leti, Soitec

Le **Leti**, institut de recherche du CEA, et **Soitec** ont annoncé une nouvelle collaboration et un accord de partenariat de cinq ans pour conduire la R&D de substrats avancés. Cet accord donne au partenariat traditionnel Leti-Soitec une nouvelle dimension et inclut le lancement d'un centre de prototypage de classe mondiale associant les équipements des partenaires pour développer de nouveaux matériaux. Le **Substrate Innovation Centre** mettra ainsi à disposition une ligne pilote pour partager l'expertise entre le Leti et Soitec.

« Bernin 3 production line »
Creation of a new production line for Piezo On Insulator substrates (RF filters)

New infrastructures in purple
Up to 700 new employees in European R&D and Production

SOITEC ANNONCE L'AUGMENTATION DE CAPACITE DE PRODUCTION DE SON SUBSTRAT PIEZOELECTRIQUE-SUR-ISOLANT (POI) AFIN DE REPONDRE A LA DEMANDE CROISSANTE POUR LES FILTRES RF 4G/5G

Le POI permet aux filtres des smartphones 4G et 5G d'allier performance et intégration à l'échelle industrielle

Bernin, France, le 13 septembre 2019 — Soitec (Euronext Paris), un leader mondial de la conception et la production de matériaux semi-conducteurs innovants, annonce ce jour l'augmentation de la capacité de production de son substrat piézoélectrique-sur-isolant (POI) afin de répondre à la demande croissante des clients.

STMicroelectronics

New Investments supported by the IPCEI initiative in France and Italy:

- 300mm Crolles Gateway extension and

and

- R3 300mm construction in Agrate

❑ RDI and First Industrial Deployment in French ST's sites and labs

❑ Technology development and new circuits on FD-SOI, embedded NVM, Imaging Sensors, Power GaN, etc.

❑ RDI and First Industrial Deployment in Italian ST's sites and labs

❑ Technology development and new circuits on BCD, MEMS, SiC, RF GaN, Digital microprocessors, etc.

Semiconductor Fab in Dresden

R&D and First Industrial Deployment
Power

Start of Pilot Production end of 2021

Up to 500 new employees in European R&D and Production

Börsen-Zeitung
Datum: 08.10.2019 Mediengattung: Print
Bosch wertet Silicon Saxony auf
Seite: 9

SiC Line in Reutlingen

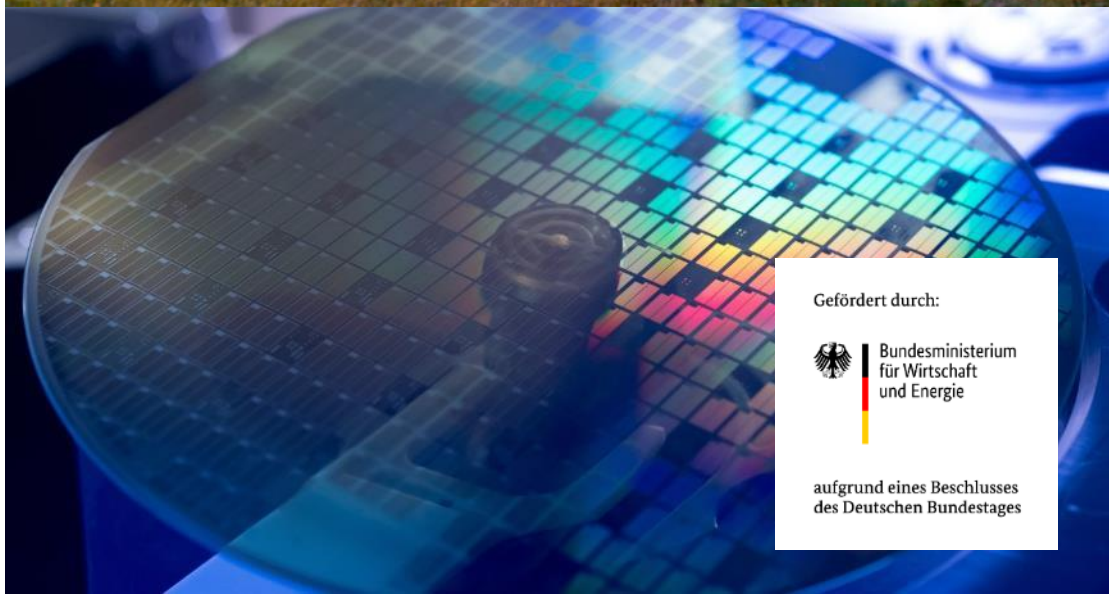
Differentiating new tech for electric mobility and renewables
Opportunity for European Leadership

Automotive News
Datum: 07.10.2019 Mediengattung: Online Visits: 167462

Bosch to produce range-boosting microchips for EVs

The New York Times
Datum: 07.10.2019 Mediengattung: Online Visits: 22839652

Bosch to Make Silicon Carbide Chips in Electric Vehicle Range-Anxiety Play



Gefördert durch:
Bundesministerium für Wirtschaft und Energie
aufgrund eines Beschlusses des Deutschen Bundestages

New EUV Optics Fab in Oberkochen

- R&D and First Industrial Deployment for next generation High NA EUV Optics
- First high NA EUV optics system manufacturing has started
- About 1000 new employees for R&D and production in Europe since project start

Handelsblatt

Zu teuer?

Carl Zeiss macht der Chipbranche Mut

EUV lithography revisited

After three decades of development, a new generation of lithography machines has now been shipped; it uses extreme ultraviolet (EUV) light at a wavelength of 13.5 nm to make silicon features down to a few nanometers in size.

https://industrieanzeiger.industrie.de/technik/euv-kooperation-katapultiert-eu-in-liga-der-chipfertigung/#

„Es gibt keine Alternative zu EUV"

Der Vorgänger der EUV-Lithografie, das Deep-Ultraviolet-Verfahren (DUV), hat seine physikalischen Grenzen erreicht. EUV schafft eine Lichtwellenlänge von

Puces : une alliance européenne se dessine

Le néerlandais ASML et les allemands Trumpf et Zeiss ont mis au point une nouvelle technologie.
Celle-ci permettra de fabriquer des puces plus performantes.

tes totales de 3,6 milliards d'euros en 2018). Zeiss (30 000 employés) estime quant à lui que cette technologie générera d'ici 2 à 3 ans plus de la moitié du chiffre d'affaires de sa division semi-conducteurs (1,5 milliard d'euros l'an dernier).

Car l'optique de précision de Zeiss joue un rôle primordial dans la prochaine étape technologique, toujours basée sur l'EUV, à laquelle tra-

Les défis de la lithographie extrême ultraviolet

Zeiss SMT – schon bereit für die nächste Generation

HALBLEITERINDUSTRIE EUV-Technologie ist serienreif. Darauf haben die Halbleiter-Giganten Intel und Samsung lange gewartet. Wie Zeiss und Trumpf ihrem Partner ASML zum Weltmarktführer von Chipmaschinen gemacht haben. Und bald kommt EUV High NA. Von Winfried Hofele

22FDX in Fab 1 is a proof point for GF's successful diversification strategy!

mdr MITTELDEUTSCHER RUNDFUNK

Aufschwung im Silicon Saxony

Design & Reuse

Globalfoundries sees success for its diversification strategy

Elektronik

Hgh-Tech-Sensorik für IoT-Start-Ups

eeNews EUROPE

GloFo, Fraunhofer, NBT launch startup for IoT chips

all-electronics.de
ENTWICKLUNG. FERTIGUNG. AUTOMATISIERUNG

EU unterstützt Mikroelektronik mit 1,75 Mrd Euro

DW Made for minds.

EU erlaubt millionenschwere Mikrochip-Förderung

Markt&Technik
DIE UNABHÄNGIGE WOCHENZEITUNG FÜR ELEKTRONIK

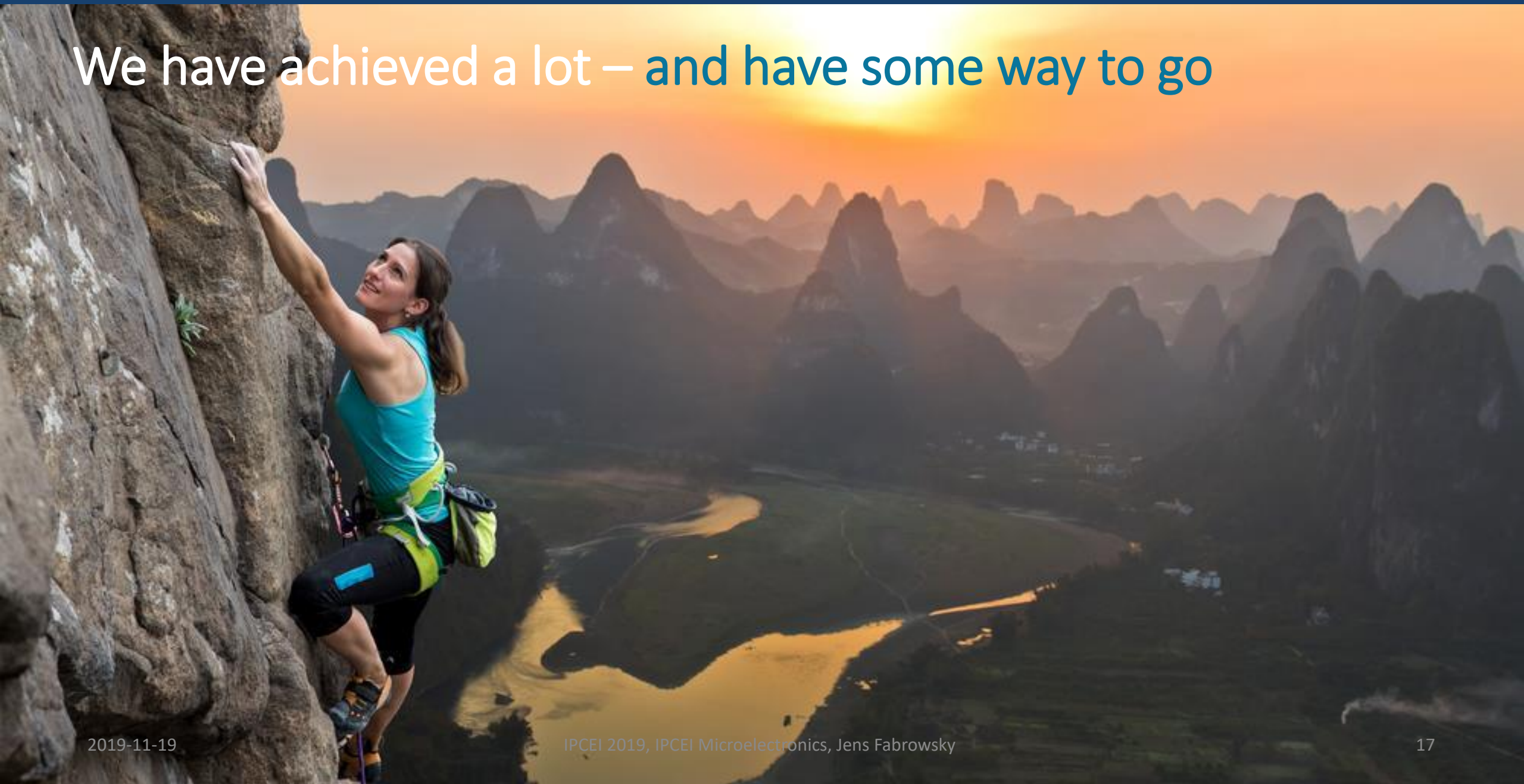
Neues Start-up vermarktet Sensorplattform

Handelsblatt

US-Chiphersteller Globalfoundries will in Dresden kräftig investieren

Current challenges

We have achieved a lot – and have some way to go



Summary and Outlook

- IPCEI on Microelectronics is a success!
  - Stimulating substantial investment
  - Jobs and Know-How in Europe
- IPCEI tool can be improved further,
  - to attract more industrial investment in microelectronics in Europe
- International challenges remain, have even increased
- Need for European technology sovereignty is evident
- Europe has strong opportunities in emerging microelectronics technologies needed to serve megatrends and achieve societal goals.

Europe needs to continue to act jointly to achieve technological sovereignty, and to keep and strengthen it's strategic manufacturing base in microelectronics

IPCEI are an important tool to bring technology to the level of First Industrial Deployment and should be continued and further developed.