

European Nanoelectronics Forum 2009



EVENT HIGHLIGHTS THE INCREASED EUROPEAN FUNDING FOR NANO ELECTRONICS R&D

The second European Nanoelectronics Forum was organised jointly in the Netherlands by the EUREKA cluster on nanoelectronics CATRENE and the ENIAC Joint Undertaking (JU). The event in Noordwijk on 17 and 18 November 2009 attracted more than 200 key players from industry, academia and public authorities. The success of these two public private programmes is proven by the increase in funding for collaborative research on micro- and nanoelectronics in Europe. This serves as a driver for industrial competitiveness in response to the current economic and financial crisis that has hit the world of electronics in an unprecedented way.

"The electronics industry is an engine and enabler of many other industrial sectors and of a broad range of innovative applications in almost every field: from transportation to health-care, from energy conservation to security," pointed out Maria van der Hoeven, the Netherlands Minister of Economic Affairs in her welcome address. "Without ready access to these technologies, our competitive position is seriously at risk."

Minister van der Hoeven highlighted the need for international co-operation to make better use of the vast resources of expertise available in Europe



Maria van der Hoeven, the Netherlands Minister of Economic Affairs

to maintain a leading role as innovator and entrepreneur in nanoelectronics. The Netherlands is strongly committed to such collaborative R&D in micro- and nanoelectronics. It was involved in the founding of the EUREKA ICT clusters and is strongly in favour of the more recent Joint Technology Initiatives (JTIs).

"ENIAC and CATRENE operate in different settings, but both share the same goal: strengthening the competitive position of the European electronics industry in the global playing field," pointed out the Minister. "Our ambition should be to develop a common overall strategy, taking into account the qualities of each instrument."

Established programmes

CATRENE is a four-year EUREKA Cluster programme, following on from MEDEA+, and scheduled to finish in 2011 but preparations are being made for a four-year extension. Eight of

the eleven projects in Call 1 are already running. All nine labelled projects in Call 2 are in start-up mode, with funding negotiations ongoing. Calls 1 and 2 involve 289 partners from 14 countries with a total effort required of 6,720 person-years. These projects provide good coverage of all work areas listed in the CATRENE White Book. The main structural change from MEDEA+ to CATRENE is an increase in SME participation.

ENIAC is a ten-year programme, running to 2017 but with final funding commitment in 2013. Call 1 resulted in seven projects accounting for €206.9 million with €95.7 million from the public authorities; Call 2 project selection is close to completion – total eligible cost is expected to be around €244.5 million with €102.7 million from public authorities. The number of countries involved to date is slightly higher than in CATRENE.

Semiconductors a success

The semiconductor industry has been a resounding success over the past 40 years, according to René Penning de Vries of NXP Semiconductors, who is President of AENEAS*, Chairman of the ENIAC Governing Board and member of the CATRENE Board. It has not only enabled the IT industry to grow but now offers many consumer benefits, and is becoming more and more society driven.

While chipmakers are facing major challenges in Europe, including consolidation, competition from Asia, commoditisation and costs, there are also increasing opportunities available through technology diversification. However innovation is essential to outperform the global competition and reverse existing trends.

"We have lots of ideas and capabilities here but lack endurance," said Penning de Vries. Governmental commitment is



René Penning de Vries

essential to keep business in Europe as are public-private partnerships at national and European level. Governments can also help the semiconductor industry by acting as launch customers.

R&D spending needs to double

Andreas Wild, the recently appointed executive director of the ENIAC JU, gave an overview on milestones achieved on the way from setting up the European nanoelectronics initiative a couple of years ago to now a legal unit with community bodies and their functions. He also outlined the vision of the Joint Undertaking as "leveraging the public-private partnership to contribute significantly to sustainable nanoelectronics R&D in Europe." For ENIAC JU call 1 – and call 2 will not be too different – public support is in the range of €100 million. "This is not enough," he said. "Spending needs to double for ENIAC JU but also CATRENE should double."



Andreas Wild

Financial analysis shows need for focus

Jerome Ramel of BNP Paribas identified both the financial weaknesses and strengths of European semiconductor manufacturers. Generalist integrated device manufacturers (IDMs) have shown the greatest loss of market share while more focused companies have gained. Moreover, fab-less companies and foundries were enjoying the strongest sales growth to the cost of the European IDMs.

Major European chipmakers have reacted by pulling out of memory production, selling less profitable businesses and combining operations. And European players have started to implement fab-light models, but in-house production is still high compared to American peers. Europe has strengths in specific areas, which include: automotive, with three European players in the top five; industrial, with clear leaders in power semiconductors; and wireless, where two companies are among world leaders. At the same time, Europe remains strong in mobile handsets, although competition is heating up.

"The European semiconductor industry is suffering from lower profitability compared to US, but has a very strong position in growing markets," concluded Ramel. "The acceleration in vertical disintegration and recent portfolio pruning should help improve the focus of R&D, key to producing premium products,

*AENEAS is a non-profit industrial association, continuing the activities of the ENIAC Platform and representing the Nanoelectronics RTD partners in the ENIAC Joint Undertaking

which will in turn translate into better market share. However, at the very beginning of a new cycle, even greater R&D effort is required."

What strategy for semiconductor fabrication?

Dr Reinhard Ploss of Infineon reflected on the necessity for semiconductor manufacturing in Europe: "If we do need to manufacture here, what and where should we do it?" Semiconductors provide key technologies for nearly all industrial sectors but the costs for the human factors involved must be compensated by investing for innovation. Investment should be based on technology differentiation. "Capacity and costs are going up dramatically for deep submicron technologies," he pointed out. "Different applications and products need individual ways for differentiation - effecting technology and manufacturing strategy."

It is increasingly difficult for one company to provide the volume to fill an advanced nano fab. However a fab-light strategy for submicron CMOS logic devices leads to a change in the value chain, with identical standard processes available for partners and competitors. Such a strategy is suitable where differentiation can be based on application, software and design know-how. An alternative is the 'innovation' fab, where technology and manufacturing are key elements for differentiation along the value chain.

Semiconductors are essential enablers for many innovative and knowledge-based products. Worldwide competition is harsh and unbalanced. Market share for European companies depends on the whole range of cost performance and consequently differentiation capability. "Whether going for a fab-light or an innovation fab strategy, know how and an innovation base in Europe is a prerequisite," concluded Dr Ploss.

Do we need Moore?

Moore-than-Moore technologies can add value to new applications in health, transport, security and energy, according to Laurent Malier of CEA-LETI. Medical and automotive sectors are the fastest growing and Europe has a strong position in both as it has in the industrial sector and in communications. It also has a strong ecosystem with research and technology organisations playing an important role. However equipment manufacturers want solutions and there are few More-than-Moore-only competitive answers. Access to system-on-chip technologies is essential – meaning selection and focus on More Moore is crucial for Europe. "While More than Moore is a chance for Europe and our ecosystem is good, More than Moore is not 'Rather than Moore,'" he concluded.

Bottom up approach needed to R&D

A crucial difference between Asia and Europe is that industries lead the way in Asia, with Asian governments racing to catch up with each other, according to Prof. Henrik Enderlein of the Hertie School of Governance in Berlin. Europe negotiates agreements and then tries to apply them top down. "The Asian way is flexible, open and bottom up," he said. "EUREKA and its Clusters are key instruments to such a bottom-up approach in Europe."

Prof. Enderlein believes new forms of co-ordination are required for effective R&D co-operation in a globalised economy. And he sees the EUREKA approach as best practice with money following ideas. "We have lost 15 years with the top-down Lisbon research agenda", he said. "Bottom-up is the right approach but is not sufficient."

His proposal for research in Europe: re-think the European budget; create an internation-



Prof. Dr. Henrik Enderlein

al level playing field; create a functioning educational system; provide better financing; encourage bottom-up initiatives; and connect such bottom-up initiatives to the EU. "Eureka and the EU should act jointly!" he concluded.

Broadband driving change

"Handsets are increasingly replacing devices such as MP3 players and cameras," said Thierry Tingaud of ST-Ericsson. ICT makes an important contribution to economic growth and broadband is a key enabler. "For every 10 percentage points of growth in broadband penetration, the GDP of a country grows 1.2%. Europe must lead in broadband technologies. We have the talent, skills and motivation." Much of this innovation is driven by services and applications. "We need open software and high performance wireless devices," he insisted. "This means new chipsets and operating systems to allow desktop experience on smart phones." Semiconductor technology and embedded software is the driving change. The value chain is evolving as well with new ecosystems offering new opportunities. "European collaboration is key but needs focus," he added. "We have the capacity but it needs co-operation. By 2020, wireless communications will play a major role with connections any where, any time and to any network."

Opting for pragmatic delineation

In his closing speech, CATRENE chairman Enrico Villa stated, that there is no competition between the two funding tools CATRENE and ENIAC. "It is decisive that both programmes together show a significant increase in European public-private funding for collaborative nanoelectronics R&D", he added. "Our intention is to ensure delineation between CATRENE and ENIAC in a pragmatic way at project level," he explained. "CATRENE is better suited to projects involving a limited set of partners/countries or where there are dedicated decision-making processes relevant to national strategic needs."

The two collaborative programmes do offer a single overall strategy addressing European industrial competitiveness in the nanoelectronics sector, insisted Villa. "The objective is to enable all European member states to have access to advanced knowledge and technologies, and to reinforce the positioning of Europe at the leading edge of global competition."

Summing up the two forum days, Enrico Villa emphasised: "our purpose in this forum has been to build our network and share knowledge about our projects. We have had some interesting and thought-provoking presentations, particularly on the financial implications for the European micro- and nanoelectronics industry. R&D is only effective if the results are exploited."



Enrico Villa

Key enabling technologies

The European Commission published an important document entitled 'Preparing for our future: Developing a common strategy for key enabling technologies in the EU' at the end of September. Mastering technologies such as nanotechnology, micro- and nanoelectronics are of exceptional importance in managing the shift to a low carbon, knowledge-based economy, and should lay a stable foundation for well-paid jobs and allow for sustainable, shared growth. The Commission intends to develop short- and longer-term competitiveness strategies for these key enabling technologies. Industry welcomes this initiative and is looking for a strategic approach for an innovation policy through very concrete measures. This initiative is an important element for developing Europe into a breeding place for innovation, with spectacular evolutions expected in communications, healthcare, energy conservation, digital content and entertainment, transportation and security.

Case history

ENIAC E3Car project: Nanoelectronics for an energy-efficient electrical Car

This project aims to build a solid nanoelectronics technology base for Europe to achieve 35% energy savings in vehicle use based on devices, circuit architectures and modules to build efficient components for electrical vehicles and demonstrate in the final systems. This will involve:

- Establishing standard designs and platforms for electric/hybrid vehicles with significant industrial, economic, innovation and societal impact to open up the path to the all-electric vehicle; and
- Developing efficient and smart semiconductor components for the first industrial generation of energy-efficient electric vehicles.

The project involves 33 partners from 11 countries with a €44 million budget.

Contact: Reiner John, Infineon Technologies



Case history

MEDEA+ 2T204 ELIAS project: End-of-life Investigations for automotive systems

A car can have up to 50,000 parts, so quality is essential to make it work as a small defect can have a large impact. ELIAS has developed accelerated test and simulation methodologies providing standardised predictions of component lifetimes and speeding introduction of longer-lasting devices. This involves:

- Extensive model validation of major stress mechanisms;
- Accelerated measurement methods for fast reliability checks; and
- More accurate lifetime and end-of-life predictions in less time.

The project involves 11 partners from 5 countries with 135 person-years of effort.

Contact: Charlotte Rohr, Robert Bosch



Case history

ENIAC IMPROVE project: Implementing manufacturing science solutions to increase equipment productivity and fab performance

This project aims to find manufacturing science answers to scaling down CMOS and managing high mix and heterogeneity. It will determine what type of process control systems are needed to manufacture ever smaller CMOS devices in high volumes at reduced cost per die and to handle large numbers of products in different technologies running concurrently through the manufacturing fab. Objectives include:

- Improving process reproducibility and quality;
- Improving the effectiveness of production equipment; and
- Shortening cycles time.

The project involves 35 partners from more than 6 countries with a budget of €36 million.

Contact: François Finck, STMicroelectronics



Case history

MEDEA+ 2A702 NanoTEST project: Manufacturing test technologies for SoC and SIP

Testing costs have exploded with growing device complexity. NanoTEST set out to create breakthroughs in manufacturing testing by developing new test methodologies for SoC and SIP devices aiming for

- 10x reduction in cost;
- 10x shorter time to market; and
- Zero defect quality.

A series of innovative methods and tools have already been deployed in the partner organisations, leading to improved quality, low testing cost and faster time to market.

The project involved 10 partners from 4 countries with 400 person-years of effort.

Contact: Kees Veelenturf, NXP Semiconductors



Automotive component accelerated testing project wins 2009 Noblanc Award

The 2009 Jean-Pierre Noblanc Award for Excellence went to the MEDEA+ 2T204 ELIAS project for achievements in accelerated test and simulation methodologies to speed up the introduction of robust new electronic components for the automotive industry. This Award honours the most innovative and sustainable project carried out in MEDEA+ and was presented during the European Nanoelectronics Forum in the Netherlands. Three projects were short-listed; the other two were 2A708 LOMOSA+, where results are reducing power consumption in mobile devices, and 2A702 NANTOTEST, already reducing the costs of manufacturing testing for ever smaller devices.

Micro and nanoelectronics are continuing to be drive innovations in all types of vehicles. However devices have to withstand extreme conditions for extended periods as the smallest defect can have a major impact on accident risks and call-back costs. The MEDEA+ 2T204 ELIAS project set out to develop test methodologies to accelerate the introduction of more robust devices.

Partners have developed and validated modelling of major stress mechanisms, accelerated measurement methods to speeding up reliability investigation and obtain fast feedback on failure modes, achieved more accurate lifetime and end of life predictions in less time and developed an improved zero-defect strategy.

As a result of ELIAS, partners have already been able to improve measurement methods and new models with appropriate software tools, suitable for the design flow, and acceptance of these methods/models by major players – including JEDEC standardisation. The results will enable more accurate prediction in less time as well as full and fast exploitation of the benefits of new technologies.

Boosting low power expertise

As mobile devices become ever smaller yet more powerful, designers have had to face up to the problems of preventing the heat degradation generated from increasingly dense system-on-chip (SoC) solutions. The MEDEA+ 2A708 LOMOSA+ project developed new low-power chip-design methods for mobile applications from phones to multimedia equipment that have enabled an overall reduction of 30 to 40% in power consumption.

The overall result of the project has been to boost European low-power expertise – a key

driver for SoC technology. This will accelerate the development of battery-operated devices combining high computing power with ultra low power dissipation and low cost, enabling Europe to remain in the global vanguard through development of world-beating products.

Reducing chip testing in production

Chip testing has become an increasingly significant part of total production costs. Advanced test technologies are required to detect defects becoming apparent as manufacturing techniques have advanced into the nanotechnology arena and automated production has shortened time-to-market, particularly for SoC and system-in-package (SIP) applications. The MEDEA+ 2A702 NANTOTEST project developed advanced and innovative test methods that reduce costs and the time required – increasing the speed of the introduction of new products in the latest technologies.

Many of the partners have already applied the technologies and approaches developed to their own product development and manufacturing cycle. The test technologies developed in NANOTEST will be key contributors to the commercial success of products in the new technology nodes, and thus to the competitiveness of the European microelectronics industry.

