Annual Work Programme 2009

Preface

This document was prepared by the AENEAS association of R&D actors in the field of ENIAC and further edited under the responsibility of the interim Executive Director on behalf of the ENIAC Joint Undertaking. It is to be read in conjunction with the Strategic Research Agenda of the European Technology Platform ENIAC; the edition of the ENIAC Multi-Annual Strategic Plan issued in April 2008, and Council Regulation 72/2008 of December 20, 2007, describing the rules and procedures of the ENIAC Joint Undertaking.

This Work Programme has been developed on the basis of consultations with the research and industrial community which included the participation of SMEs, and with the help of a questionnaire, first to establish the ENIAC Strategic Research Agenda (SRA), then the Joint Undertaking Multi-Annual Strategic Plan and the Annual Work Programme 2009.

Content

1 Introduction

1.1 The context

Nanoelectronics is the essential hardware enabler for the innovation of electronic products and services in key growth markets for the European industry. In 2004 a High Level Group of key representatives published its 'Vision 2020' for Nanoelectronics and launched ENIAC, the European Technology Platform for Nanoelectronics, with the overall aim to guarantee Europe the earliest possible access to leading-edge integrated components, miniaturized electronic (sub)systems and design skills for application in high-technology products and services, thereby reinforcing Europe's existing industrial strengths and ensuring that core intellectual property is generated and benefited from in the region. As a result of the work of the Technology Platform, the ENIAC Strategic Research Agenda (SRA) was established through the voluntary and concerted efforts of experts from industry, academia, and public authorities across Europe. This SRA is revised regularly. Its 2nd revision was published on November 28, 2007. The ENIAC SRA is the common envelope guiding the definition and execution of R&D in Nanoelectronics in Europe for all players (industry, academia, and public authorities) and all mechanisms for public-private partnership (national, transnational, and EC). Top executives of leading European companies and research organizations have signaled their full commitment to reaching the ambitious goals set out by the SRA.

Anticipating a more coordinated and efficient implementation of the R&D activities highlighted in the ENIAC SRA, a group of key stakeholders cooperating within the ENIAC Technology Platform established the AENEAS association to foster a more focused participation of all industrial and academic stakeholders actively engaged in the definition and execution of Nanoelectronics R&D in Europe.

In order to execute part of the cooperative research and development activities required to fulfill the SRA, a dedicated entity was established as the concrete implementation of a public/private partnership between industry, grouped in the AENEAS association, several Member States and the European Commission. That entity, called the ENIAC Joint Undertaking (JU), was set up by Council Regulation 72/2008 of December 20, 2007, aiming at combining the public and private efforts needed for resolving the downstream-oriented research priorities in the ENIAC SRA.

The Council Regulation states that the Joint Undertaking will have its own Research Agenda (RA). The Research Agenda of the JU closely follows the recommendations of the Strategic Research Agenda of the ENIAC Technology Platform. It addresses the downstream activities related to equipment, materials and processes, the manufacturing and design of Nanoelectronics components and miniaturized (sub)systems, and their use in various application fields.

The JU RA is a subset of the ENIAC SRA since other European and national programmes – including Eureka - also contribute to the goals of the ENIAC SRA, as well as individual industrial and academic research activities. Therefore, no additional document was generated. In particular, the ENIAC RA focuses on research that can deliver prototype or demonstrator solutions with high cross-domain applicability to address specific and important societal needs. The more upstream activities and some very specific activities complementary to the JU cooperative research activities are planned to be covered under the regular Framework Programme 7 type of activities or by research in institutes, universities and companies funded by the individual Member States.

In 2008, first year of operation of the ENIAC JU, a Call for Proposals was launched on 8 May closing on 3 September. Sub-Programmes 2, 3, 4, 7 and 8 were opened for proposals. Resulting from the evaluation process, 8 projects were launched at the end of 2008: 2 in SP2, none in SP3, 1 in SP4, 1 in SP7 and 4 in SP8.

1.2 The JU research strategy

In the statutes of the ENIAC JU, the Multi-Annual Strategic Plan (MASP) defines the strategy that the JU will follow to ensure that the RA can be executed under the most favorable conditions: how the RA can be supported, how it will be financed, and how it will be managed. The AENEAS association is chartered by the IRC to draft this MASP that outlines the JU strategy and plan as it evolves over time as a function of research priorities and stakeholder commitments.

The selection of topics within the MASP is primarily along the axis of long-term societal needs and lead markets. The six societal segments identified in the ENIAC SRA are Health & Wellness, Transport & Mobility, Security & Safety, Energy & Environment, Communication, and e-Society (replacing Infotainment), leading to segmentation in six application-specific Sub-Programmes in the MASP (respectively SP1 to SP6). Many of the challenges listed in the ENIAC SRA technology domains can be mapped on the applications in these lead markets, notably topics from More Moore, More than Moore, and Heterogeneous Integration. It should be recognized that commonalities continue to exist in many basic technologies underlying the various application-specific Sub-Programmes. Also the priorities within these technologies can be the same, the difference being the timing or the level of maturity needed. However, in the technology domains Design Methods and Tools, and Equipment and Materials, cross-domain and cross-application aspects are dominant. Challenges in these domains can be better handled as generic enablers, serving all ENIAC societal needs and lead markets. Therefore, the application specific Sub-Programmes SP1 to SP6 in the MASP to cover the RA are complemented with two Sub-Programmes SP7 and SP8 that are technology-specific, bringing the total to eight. The mixture of technology- and application-driven Sub-Programmes, seeking maximum synergy between the various application Sub-Programmes while at the same time recognizing their individual socio-economic value and their capability to drive wider technological progress, will guarantee an efficient set-up of the entire programme.

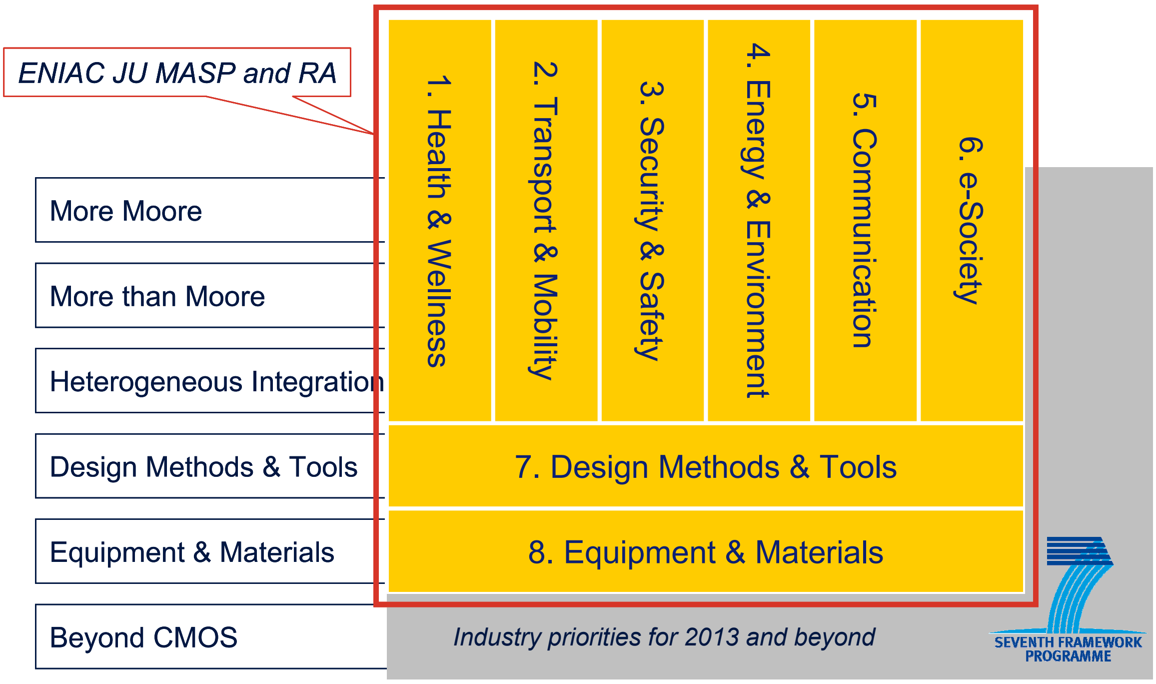

Figure 1 – Mapping the JU RA on the SRA technology domains

Not covered in the MASP are the upstream oriented R&D priorities identified by the ENIAC SRA for the period beyond 2013 in the domain More Moore, More than Moore and Heterogeneous Integration and most of the content listed for the technology domain Beyond CMOS.

These priorities are recommended for inclusion in the coming calls in the regular FP7.

Also specific supporting activities related to equipment assessment, standards, international cooperation, etc… are to be covered in FP7. Furthermore some activities related to the research on the most advanced process technologies which are better executed in a wider international context are also not directly covered. Further synergy exists with the more application-oriented activities in CATRENE (EUREKA cluster project 4140) and with the embedded systems covered by the ENIAC JU.
It is planned to update the MASP regularly and have it agreed by the GB in the same frequency as that of the ENIAC SRA that is every two years. A new revision is also forecasted by year 2009.

1.3 The priorities for 2009

The present document is the Annual Work Programme for 2009. It defines the content and scope of the single Call for Proposals focusing on downstream-oriented research to be launched in 2009. The text of the Call for Proposals will further detail the available budget and the eligibility criteria, taking into account the requirements of both the European Commission and ENIAC member States.

The selection of the Sub-Programmes from the Multi-Annual Strategic Plan leads first to keep the two transversal Sub-Programmes open (SP7 and SP8), since they are essential to nurture the technological competencies in design and manufacturing which help ensure the completeness of the value chain in Europe. Within these Sub-Programmes, indications are given regarding some R&D orientations that seem currently important. This allows a further prioritizing within the Sub-Programmes.

Among the application Sub-Programmes, a specific approach was followed with respect to the topics already covered in 2008 and those opened for the first time in 2009. Guiding principles in the Sub-Programme focusing were:

- to identify topics of sufficiently wide interest to justify large scale cooperative research projects, finalized to enable clearly identified applications, following the basic rationale for the JTI, which is to support projects for which "*the scope of a RTD objective and the scale of the resources involved justify setting up long term public private partnerships*"[1]. In 2009, this applies to SP1, SP5 and SP6;
- to work on complementary, focused activities in relation with the topics covered by the large projects launched in 2008. This is done in SP2 and SP4;
- to address again the full scope of SP3 given the lack of positive results in this field in 2008.

This focused selection is large enough to allow a number of good proposals and also to allow all Sub-Programmes to be addressed within the call of 2009. A more focused approach would have led to a wait time of 2 years for entire Sub-Programmes which probably would have excluded significant actors for a too long duration. At the same time, taking the expected increase in budget into account, in the second year there are additional provisions to cover activities of a smaller scale to complement the larger projects already started after the call in 2008, thus allowing better access opportunities for SME's and new access countries.

This prioritization amongst Sub-Programmes and within Sub-Programmes will be a continuous process. It is expected that future calls will cover only a limited number of Sub-Programmes but their selection will depend on the yearly evaluation of research priorities.

The present document summarizes the priorities for the 2009 ENIAC AWP as identified by the IRC and adopted by the PAB of the JU on the basis of the guidance provided by the current MASP and field interviews within representatives of the AENEAS members and other

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[1] COUNCIL DECISION concerning the seventh Framework Programme of the European for research and technology development activities (2007 to 2013)

stakeholders in the Nanoelectronics R&D ecosystem. It covers 4 fully-fledged application oriented Sub-Programmes, 2 limited application Sub-Programmes and the 2 technology-driven Sub-Programmes. Within each of these, a set of target activities gives further focus and indications regarding major short and mid term R&D needs. Each of the topics listed is a relevant research priority item contributing to resolving the market- and society-driven technology challenges for the corresponding ENIAC Sub-Programme, calling for industrially-driven projects of high economic or socio-economic relevance. A section on synergy with other priorities underlines the importance to address activities with a wide application or cross-cutting potential. Each proposal should address *at least* one target activity in one Sub-Programme and clearly identify which ones have been addressed. Given the transversal field of applications of most Nanoelectronics technologies it is also expected that some proposals could address more than one Sub-Programme. The expected industrial or socio-economic impact is highlighted. Proposals should demonstrate how they will generate such direct or indirect impact. Indications towards a targeted approach are given as guidance for potential applicants.
It should be kept in mind that the wording, size and duration of the items in the list are illustrations for the priorities, not specifications for the expected projects.

In line with the objectives of a Joint Technology Initiative, offering the potential for larger Europe-wide initiatives, with more flexibility, increased efficiency, no restriction in duration or size, it is expected that a vast majority of large, integrated projects are launched in order to have a significant industrial impact and to demonstrate sufficient critical mass The consortium size or amount of resources is naturally also dependent and should be guided by the topic and needs of the proposed project. Some Sub-Programmes or target activities may also be covered by a mixture of projects of different sizes. The limited-scale Sub-Programmes are designed to trigger smaller but more focused proposals.

Within each integrated project, a realistic representation should be found for the underlying Nanoelectronics R&D ecosystem in Europe, including large corporations, SME's, institutes, and universities. The mechanisms to accommodate smaller partners, SME's, institutes or universities in larger integrated projects can vary from direct participation in the project, to special links with one of the direct project partners, or via a set of linked smaller projects.
Such linked activities or projects are also accommodated through the call for targeted activities following the start of the large projects selected in 2008.

The indicative resources can obviously not be reached in terms of funded projects in each and every Sub-Programme for this year, and the repartition will be adjusted depending on the quality of project proposals. It is just a rough indication of the estimated size it could have if the subtopics outlined for this year would all be covered in a specific Sub-Programme. It does not take into account potential synergy between the different Sub-Programmes or target initiatives. The proposals should anyhow largely exceed these figures. This approach might evolve over time depending on the feedbacks received and the requirements of the MASP.

2 R&D priorities for 2009

2.1 SP1 - Nanoelectronics for Health and Wellness

Introduction

This Sub-Programme deals with the development of Nanoelectronics technologies and components for applications in the field of Health and Wellness. The main drivers in Europe are the ageing society and the raising of health standards with a simultaneous reduction of the associated cost. Main priorities in applications are early diagnostic and prevention, targeted, minimally invasive and/or portable therapies, remote parameter monitoring, smart prosthetics as well as tools and methods for analytical and research laboratories.

Target activities

Industrially driven projects for Nanoelectronics Research for Health and Wellness will address the areas of:

- **Miniaturised biochemical sensor for diagnostics:** to improve sensitivity, specificity, multi-parameter capability, miniaturisation and reliability. Application areas are DNA analysis, proteomics, and identification of virus and bacterial infections. Main target is the development of all basic technology modules (e.g. micro-fluidic, micro valves, MEMS for liquid or drop handling, integrated sensors, etc.) combined with low power control logic and possibly energy scavenging most likely through heterogeneous integration. High reliability under harsh conditions is an important requirement. Efficient and shorter test and qualification methodologies will also need to be developed, together with system architecture, design methodology and tools.
- More **targeted therapy** will be achieved by combining imaging with therapy, which will assist in healing or eradicating specifically diseased tissues. Testing in real time individual response to drugs will help to tune the therapeutic protocol and reduce side effects in conjunction with telemedicine for a better patient coaching. Smart drug-delivery systems, based on MEMS technology will help to apply therapy where and when it is needed. Specific techniques like heat and/or light therapy can be used to accelerate rehabilitation, while direct electrical stimulation (e.g. pace makers) will particularly benefit from miniaturization and real-time patient specific protocols.
- **Advanced imaging capability for diagnostics and healthcare** (e.g. surgery) in real time using different wavelengths in the whole electromagnetic spectrum, and with 3-D capability. It will require new detector materials and devices (with enhanced sensitivity and dynamic range, lower noise and multi-spectral and high-speed capability) and advanced digital data processing and storage for image processing and analysis.
- **Ultra-low power devices and energy-scavenging** will be made possible by the continuous progress of leading edge Nanoelectronics: this will particularly benefit wireless portable or implantable systems, and stay within the maximum thermal loads that implanted devices can impose on the human body by a better power efficiency.
- **Remote patient supervision** using multi-parameters biosensors and telecommunication networks will improve the quality of the clinical environment and favor a therapy at home, addressing through the same technologies the wellness of the patient, the cost of hospitalization and the monitoring of elderly people and of patient requiring prolonged medical care.

Synergy with other priorities

Possible synergy areas with other priorities are (not excluded):

- Heterogeneous integrated Microsystems design methods will also find use in the Sub-Programme 7: “Design methods and Tools for Nanoelectronics”.
- Heterogeneous integration technology will be a basic technology usable also in the Sub-Programme 8: “Equipment and Materials for Nanoelectronics”.

- Low power electronics and energy scavenging will be required also for SP5 and SP6.
- Dedicated technology and devices for energy harvesting could be covered also in SP8.
- Fast test and qualifications methods for Microsystems under harsh environments will also be valid for Sub-Programme 2: “Nanoelectronics for Security and Safety”.
- Remote patient monitoring can be synergic with SP6 for Ambient Intelligence, especially in the area of Ambient Assisted Living.

Expected impact

Micro/nanoelectronics offers powerful ways to bring added value in innovative solutions for a better personal health and wellness, in terms of cost, sensitivity, accuracy, automation, user-friendliness and new functionalities. This applies in healthcare applications such as prevention, screening, diagnostics, treatment (including drug delivery), patient monitoring and minimally invasive disease intervention. Also areas like environment control (water, air, soil, etc.), agriculture and food are expected to benefit from innovations in this medical domain.

Targeted Approach

Large scale projects are targeted that could start within the first year in these areas or crossing these areas, developing basic technology until demonstration in a final system, involving the cooperation of users (hospitals), semiconductor companies, design houses, assembling and packaging companies and relevant research institutes and universities. These main projects should show both vertical integration with the final user and with equipment, materials and design providers and horizontal cooperation to build a solid technology base for Europe and establish standards.

The backbone of these projects is expected to be formed by large companies, which will stimulate and organize the participation of Sees and be supported by Research Institutes and Universities. The large scale projects will be complemented by smaller focused projects, also through the use of side calls at a later stage, with a large potential for SME and institute contribution.

Synergy should be established with other Sub-Programmes, for the development of a common, cross-functional technology base.

Possible topics of projects

- Early diagnostic and prevention through heterogeneously integrated biosensor Microsystems and imaging systems
- Medical imaging systems for smart therapy
- Systems for remote biological parameter monitoring
- Smart drug dispensing systems.

Indicative resources

project size in the range of 100-150 person year, over 3 years

2.2 SP2 - Nanoelectronics for Transport & Mobility

Introduction

The most urgent priorities in the field of Automotive Electronics are the reduction of fuel consumption, driven by increasing costs of oil and environmental concerns, and the need to increase safety on the roads, in spite of ever increasing traffic density.

Target activities

Both short term and long term research activities in the field of Nanoelectronics are required to enable the roadmaps defined by the Technology Platform for Automotive ERTRAC and in line with the SRA of the eRTD working Group of the eSafety Forum.

Industrially driven projects for Nanoelectronics Research for Transport and Mobility addressing the fields below were called for in 2008.

- **Components and miniaturized (sub)systems for Assisted driving** to increase car safety and reduce collision risk.
- **Technology, components and miniaturized (sub)systems for advanced engine control systems and exhaust and combustion control.** High temperature reliability and zero failure rate will be required for all components.
- **Power and high voltage electronics and smart miniaturized systems for hybrid and electrical cars.**
- **Development of fail safe and fault tolerant electronic systems** as a cross functional priority, which applies to all existing car electronics, and to all technologies to be developed in the above mentioned projects.

Two large initiatives were launched in these fields in 2008:

  - The project **E3Car:** Nanoelectronics for an energy efficient electrical car. The objective of the E3Car project is the development of nanoelectronics technologies, devices, circuits architectures and modules for electrical cars/vehicles and demonstration of these modules in a final systems. The project considers both vertical integration with the final user and equipment providers and horizontal cooperation to build a solid nanoelectronics technology base for Europe electrical car industry and establish standard designs and platforms for electrical/hybrid cars.
  - **The project SE2A:** Nanoelectronics for Safe, Fuel Efficient and Environment Friendly Automotive Solutions**.** The objective of the SE2A project is to create an integrated automotive control platform, enabled by breakthroughs in the areas of efficient fuel consumption, reduced CO2 emission and safe driving, to be achieved by the development of nanoelectronics components, subsystems and architectures. The project addresses the definition of carriers and specifications, the design and development of optimized control systems, the development of novel automotive process technologies and their integration into (sub)systems, design for reliability, test and yield, prototyping and functional verification of the project objectives.

In 2009, additional activities are looked for to complement and/or enhance the potential and impact of the activities launched in 2008. Such additional activities must target application-oriented studies in terms of (sub)systems, architectures, prototypes. They can test the feasibility of proven (or very promising) technological modules and know-how generated in previous R&D or by larger projects. In that context, it is important that partners further in the supply chain are involved (system makers, car manufacturers). Also extra activities adding extra features, functionalities not covered in the large initiatives in particular activities related to energy consumption reduction and in battery and battery management related aspects are encouraged.

Synergy with other priorities

Possible synergy areas with other priorities are (not exhaustive):

- Basic power and power management technology will also find use in the Sub-Programme 4: “Energy and Environment, for the control of Industrial Electronics”.
- Optical sensors will be a basic technology usable also in the Sub-Programme 3: “Nanoelectronics for Security and Safety”, even if the requirements for reliability and dynamic range will be tougher for Automotive applications.
- Safe design methodology, and Design for Reliability can profit from the results of the priority “Device, circuit, and system variability and reliability” in the Sub-Programme 7: “Design Methods and Tools for Nanoelectronics”
- System-in-Package technology will profit from the results of the priority “Assembling technology for system-in-package” in the Sub-Programme 8 “Equipment and Materials for Nanoelectronics”, even if it will require a dedicated effort for temperature control and heat management

Expected impact

Expected industrial impact relates directly to increased competitiveness of the semiconductor and the automotive industry in key lead markets. Other closely related industries such as avionics, industrial electronics or industrial equipments operating in harsh environments or requiring high reliability considerations will also benefit.

Direct social impact is also expected on mobility policy, safety and on sustainability (environmental) policies.

Targeted Approach

Large scale projects were targeted in 2008 developing basic technology up to a final system demonstration, involving the cooperation of user companies (automotive equipment and car manufacturers), semiconductor companies, design houses, assembling and packaging companies and relevant research institutes and universities. These projects should show both vertical integration with the final user and with equipment, materials and design providers and horizontal cooperation to build a solid technology base for Europe and establish standards.

In addition to these large size projects led by industry core companies, smaller projects are targeted in 2009. This will give additional opportunities especially for SME’s and research institutes to contribute by filling technology or capability gaps, or to explore initial research results that appear as larger programmes develop by feasibility studies or in different applications. Smaller projects and cooperation / coordination with larger initiatives in this field are encouraged.

Possible topics of projects

- Wireless and thermal anti-collision devices (Radar anti collision 77GHz) including the development of thermal night vision camera system beyond the range of the headlights of the electrical vehicle in dusty, foggy conditions or by night.
- Driving and load prediction algorithms and processing: Development of an integrated energy management system to predict and extend the usable driving range and the life of the battery pack based on driving, terrain and traffic profiles.
- Solar thin embedded electronics into materials (glass windows, front/back side, etc.).
- Energy harvesting and energy conversion (wind, vibration, etc.) to enhance the current charging systems in electrical vehicles and the development of electronics architectures and systems for electric energy generation from the freely available environmental resources in order to develop electrical vehicles that are partially “self-powered”.

- Energy recovery circuits and devices.

- New systems and electronics architectures that recover the temperature to manage the driven batteries temperature. Techniques to recover the heat generated by high powered semiconductors in the electric vehicle.

- Battery/supercapacitor/electronics embedded systems. Integrated electronics for the management of embedded electrical energy using a storage system with compact high voltage battery/supercapacitor hybrid source.

- Communication intra car wireless and wired. Sensor networks.

- Vehicle to infrastructure communication

Indicative resources
project size targeting in the range of 10 -20 person year, over 2-3 years

2.3 SP3 - Nanoelectronics for Security & Safety

Introduction

Security and safety is one of the major requirements for society in virtually every aspect of our lives reflecting itself in public demand for personal emergency and home security systems, and for government led protection from crime and terrorism. Moreover automatic systems are penetrating in many life sensitive applications such as in transport or health related systems putting very high requirements on the related safety aspect.

Target activities

Short and long term activities to enable new safety and security systems that need to be reliable, secure, safe, fault tolerant, easy to use and capable of safeguarding the privacy of end users.

Industrially driven projects for Nanoelectronics Research for Security and Safety were called for in 2008 addressing the areas of:

- **Trusted devices and smart secure portable objects**, will address systems aspects like multi-level security architectures, secure computing techniques; separation of concerns and specific middleware, and new hardware technologies like new memory architectures, memory management units, digital rights management units, processors and cryptographic, resistance to side-channel attacks, anti-tampering coating and packaging on–chip batteries. Segregated wireline and wireless I/Os and internal firewalls. Encrypting, passwords and access control management.
- **All-in-one imaging sensors**, including emission and active imaging, detection, processing in focal point, pupil post processing and tracking treatments. Cameras and sensors related to radar, infrared, acoustic or optical systems. Nano-electromechanical devices applied in sensors.

No major initiative was launched in this field.

Synergy with other priorities

Possible synergy areas with other priorities are:

- Basic new memory architectures, processors and basic technology for encrypting, access control will find their use in all other Sub-Programme priorities and also use in the Sub-Programme 2 "Transport and Mobility" and in Sub-Programme 5 " Communication" and 6 "Infotainment" and in Sub-Programme 4 “Energy and Environment”.
- Optical sensors will be a basic technology usable also in the Subprojects 2: “Transport and Mobility”, even if the requirements for reliability and dynamic range will be tougher for automotive applications.
- Safe design methodology, and Design for Reliability can profit from the results of the Sub-Programme 7: “Design Methods and Tools for Nanoelectronics”; programming methods and middleware have a direct synergy with activities going on in the relevant Sub-Programme in ARTEMIS.

Expected impact

Direct industrial impact is expected in personal emergency and home security systems, in increased safety and security as a generic enabler for many other applications and related services in transport, health, banking, identification, telecommunication, safety critical systems and for government led protection from crime and terrorism.

Targeted Approach

Large scale initiatives are targeted that could start within the first year in these areas or crossing these areas, developing basic technology as a common building block ("trusted devices"). From this common element, various application segments can be addressed.

Such projects should include basic technology developments until a demonstration in a final application, involving the cooperation of user companies, semiconductor companies, design houses, assembling and packaging companies and relevant research institutes and universities. The main projects should show vertical integration as well as the potential to spread developments over a wider application domain.

It is expected that the project(s) will be formed by a combination of large companies and SMEs and be supported by Research Centers and Universities. The initiative could further include or be complemented by smaller focused projects, with potential for a large SME and a large institute contribution.

Synergy should be established with other Subprograms, for the development of a common, cross-functional technology base

Indicative resources

project size in the range of 200 person year for all SP3 target activities

2.4 SP4 - Nanoelectronics for Energy & Environment

Introduction
Efficient use of energy and waste reduction are the political, social and technical challenge of the next decade. Focusing on micro-/ nanoelectronics approaches, efficient power supply and intelligent energy control in new products can reduce electrical energy consumption in Europe by 20% to 30 % until 2020 by simultaneous increase of safety, functionality and convenience. This will reduce CO_2 emission in the same order of magnitude in order to achieve the Kyoto protocol targets and will limit the energy cost increase.

Target activities
Both short and mid term activities to provide innovative technologies as the basis for new energy efficient products and intelligent power management to enable increased competence in these emerging lead markets in line with the 'sustainability' objective[2].

Industrially driven projects for Nanoelectronics Research for Energy and Environment addressing the areas of **intelligent drive control** including technology, components and miniaturized (sub)systems addressing the challenges at system and device level for highly efficient controlled engines and electrical actuation in industrial applications and efficient **power supplies** and **power management solutions,** combining the measures for voltage conversion and stand-by were called for in 2008.

One large initiative was launched in 2008. The project **SmartPM** dealing with Smart Power Management in Home and Health**.** The objective of the SmartPM project is to develop application-specific, efficiency-optimized semiconductor power technologies enabling actual deployment of intelligent systems in large-scale, energy-critical application fields like home and health. Applications in these fields require innovative system architectures and circuit designs, new components, efficient power electronic technologies, and innovative module, interconnect and assembly technologies. An important aspect is the support and the compatibility of upcoming legislation and regulations for efficient use of energy. The SmartPM will develop the semiconductor technologies and module platforms enabling intelligent motor drives for highly controlled engines and efficient power supplies and power management solutions.

In 2009, additional activities are looked for to complement and/or enhance the potential and impact of the activities launched in 2008. Such additional activities must target **low power consumption of the circuits** and their **interaction in different applications.** They can address **support activities** such as characterization, simulation and test.

Synergy with other priorities
Synergy could be established with other Subprograms, for the development of a common, cross-functional technology base. Possible synergy areas with other priorities are:

- Power management technology and intelligent drive control will also be used in the Sub-Programme 2: “Nanoelectronics for transport and mobility”.
- Synergies with design platform activities in the design of efficient power supplies, high reliability solutions, design for operation under harsh conditions.
- Synergies with equipment and materials in relation to high power electronics. Completely new or improved semiconductor technologies, using leading edge technology knowledge for low power consumption and extended lifetime (e.g. high frequent and low-loss switching, digital power conversion). New semiconductor materials like SiC or GaN, thin substrates and interconnect materials to improve performance and reduce cost. In-package integration of power devices and control logic.

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[2] Current Sustainable Development Strategy (2006): European Council *DOC 10917/06*

Expected impact

Direct impact is expected on the automotive industry, on automation and on industrial equipment and home appliances. Direct contribution should go to various environmental and sustainability policies at national and European level.

Targeted approach

Large scale projects were targeted in 2008 developing basic technology until demonstration in a real environment, involving the cooperation of user companies. These main projects should show both vertical integration with the final user and with equipment, materials and design providers and horizontal cooperation to build a solid technology base for Europe and establish standards.

In addition to these larger size projects led by industry core companies, additional smaller work areas are targeted in 2009. This will give additional opportunities especially for SME's and institutes to contribute by filling technology or capability gaps or to explore initial research results in different applications that appear as larger programmes develop. Smaller projects and cooperation / coordination with larger initiatives in this field is encouraged.

Possible topics of projects

- Efficiency of high power switches using SiC
- Thermal simulation of the components in total systems
- Test in harsh environments
- EMC requirements and their impact
- Components and applications using energy scavenging
- Transfer of the smart power technology which is targeted to home applications into the industrial or other fields

Indicative resources

project size in the range of 10 -20 person year, over 2-3 years

2.5 SP5 - Nanoelectronics for Communications

Introduction

People are becoming used to having easy access to friends, family and information services. Making information available anywhere at any time relies on connectivity and communications, increasingly via the use of wireless-based networks (e.g. GSM, 3G, Wi-Fi, Wimax networks) to meet the 'anywhere' requirement. In future, communication systems will be easier to use than today, even to the point where specific connectivity channels become irrelevant to the user. Information will simply tunnel itself to its destination by whatever communications channels are available. However, given the increasing importance of communications in social and economic life, provisions must be taken to protect privacy.

Target activities

The communication requires progress in both data processing technologies (falling under the conventional definition of “More Moore”), to increase data transfer rate, to improve the utilization of the available bandwidth, to provide more flexibility towards a variety of communication standards, and to present a more user-friendly interface to the general public, and in dedicated technologies for RF and optical interfaces, for power management and power harvesting and for display and user interfaces (conventionally designated as “More than Moore”). Given the tight power and size constraint of mobile applications, the advances of packaging and heterogeneous integration will play an essential role. In turn the equipment material, manufacturing and design technology domains are needed to contribute to the technological advances of the communication domain.

More Moore

The focus will be on an increase in computing and memory storage capability, to support the increasing volume of data traffic, and the increasing quality standards, also with more sophisticated data coding techniques. Digital technologies will be increasingly used for the improvement of analogue performances of devices. Reducing cost and power consumption with increasing performances are key requirement for widespread adoption of new communication technologies, and will require advancement in device technology, materials and design methodology.

The weight of communications on the general economic life will put a large stress on issue of the security of communication channels. Dedicated technologies and design approach must be developed to insure confidentiality of communications.

More than Moore

The main requirement will be for advanced RF technologies, capable of higher frequencies at reduced cost. Analog/RF technologies will probably make use of a variety of devices, from advanced CMOS, optimized for RF, to Bi-CMOS and also composite semiconductors for opto-electronics, low noise, very high frequency or high RF power applications.

Versatile RF technologies are required for compatibility with multiple standards, allowing Software Define Radio schemes. Adaptive front-end technologies will need tunable RF filters, and active antennas, making use of MEMS technology and new materials and devices.

Ultra-low power RF devices and communication protocols will be a critical technology for sensor networks integration to be used in several fields, from Health to Safety and Security to monitoring of structural integrity.

To achieve the desired density targets 3-D integration is needed, including passive devices, filters, antennas capacitors, either on-chip, in-package, or using “embedded die” techniques. Special packaging techniques and design are needed for RF, especially for very high frequencies, and opto-electronic compatibility.

Synergy with other priorities

Possible synergy areas with Sub-Programme 7 and 8 are:

- Essential building blocks and demonstrators to achieve cognitive radio (reconfigurable architecture, dynamic frequency selection), radio environment monitoring systems, digital signal generation techniques, innovative active beam steering, etc..
- Energy management and energy scavenging efficient designs on new technologies described above.

- Smart parasitic handling
- Testing and digital assisted analog (including calibration) are important issues for RF systems especially those touching the mm-wave real
- Ultra low power RF will be a common requirement with SP1 for medical sensors.

Expected impact

The communication domain has a pervasive effect on a broad scope of human life and activities, and there is an entry point to many other markets. This domain has many European system integration companies so the acceleration of research for micro and nanoelectronics components dedicated to this domain will help reinforce the leadership of these European companies.

Of course the development of services, though a seemingly distant effect of technological development, will be made possible by the development of improved technologies for communications. The expected mobile TV explosion is one good example.

Targeted Approach

It is expected that the projects will be formed by a combination of large companies and SMEs, and be supported by Research Institutes and Universities. Initiatives could further include or be complemented by smaller focused projects, with potential for a large SME and a large institute contribution.

Synergy should be established with other Sub-Programmes, for the development of a common, cross-functional technology base.

Possible topics of projects

- High performance, low form factor, low power devices for mobile communication units, meeting cost targets compatible with widespread availability of new communication standards.
- Cost effective technology platform for integrated RF MEMS and passive devices in packaging for communication applications.
- High performance, low power RF technologies for high bandwidth communications, cognitive radio and white space spectrum usage technologies.
- Devices and design for very high frequency and opto-electronics.

Indicative resources

project size in the range of 150-300 person year, over 3 years

2.6 SP6 - Nanoelectronics for e-Society

Introduction

The e-Society is the world that is more and more enriched by smart, miniaturised and embedded micro and nanoelectronics systems, in order to enhance our lives. This Sub-Programme deals with the development of nanoelectronics technologies and products to enable the development of e-Society. It addresses the issues involved in solving global trends like globalization, urbanization, aging population, energy efficiency, personal well-being, independent living, home care, etc.

Where a classical subject like "Infotainment" merely focuses on providing HQ multimedia content anywhere (so as to entertain and educate people), the subject of "e-Society" is much broader, as it includes all aspects that improve the quality of the human's life (so as to raise the well-being of people), business efficiency and environment protection. Europe is now entering the era where low-cost electronics solutions built earlier for the generic entertainment market will now be applied also for specific applications that enable a knowledge-based society in more general terms.

Target applications

- **Personal services:** equipment for infotainment has made technologies like digital TV available in almost every home, and provided a broad access through the web to information and public services, to increase the opportunities for remote learning and to avoid the exclusion of disabled or ageing citizens. The introduction of ambient intelligence features will improve the quality of life, making the home responsive to individual needs, allowing fine tuning of all environmental parameters and improving energy efficiency. A strong synergy with the Ambient Assisted Living initiative is foreseen. The required technology development will involve further improvement in computing and memory performances to support user-friendly interfaces (e.g. speech recognition) and cost reduction, multiple heterogeneous sensors networks, displays, low cost, low power RF technology, smart active and passive tags, energy harvesting, and power management.
- **Work and Business:** transforming Europe towards a knowledge-based economy is the main objective of Lisbon initiative. Increase in industrial productivity, introduction of new knowledge-intensive business models can be achieved through extensive use of fab automation and informatics. Automation of production processes will require new approaches towards endowing robots with advanced perception and action capabilities, including 3D sensing, motion perception, learning and control strategies and communication links for factory integration. New manufacturing approaches, based on intelligent control of fabrication parameters can reduce cycle time, improve quality, safety and productivity. High performance data processing and communication tools can support highly innovative networked businesses on top of an Internet of Services, enabling virtual organizations, facilitating dynamic outsourcing and providing new channels for consumption. The required technologies will be high performance data processing and storage for robotics, wireless and wireline communication devices, sensors and smart power electronics for engine control.
- **Environment protection:** protection of the environment is considered a critical element towards an improved quality of living. Deployment of sensor networks, linked to central coordination nodes will be a key component of environment monitoring and enable timely actions for disaster prevention and mitigation. Dedicated sensor networks, low power communication links, high performance data processing for real time reaction, power electronics for actuators are among the basic technologies needed.

Synergy with other priorities

- SP1 on "Health & Wellness" includes "Wellness", but only when related to medical applications, including the well-being of ill and disabled people. In SP6 all applications are dealing somehow with daily life "wellness", aiming at improving the life of healthy people. This can also include projects on comfort and physical activity, for fully enabled and partially disabled (yet healthy) people.

- SP3 on “Security and Safety” includes work on privacy, relevant and necessary to ensure the privacy of the citizens of the e-Society. Furthermore, the application topic on “digital identification for the e-Society” is linked to SP3 as well.
- SP4 on “Energy & Environment” includes environmental benefits of energy saving, while SP6 includes energy saving as a side-effect of improving people’s lives.

Expected impact

The impact on European society will be directly perceived by the citizens as the technology solutions for the e-society are meant to improve the quality of human’s life. Next to advanced entertainment systems for anybody, the e-Society of will allow people to move from user to generator of information content. Ambient smart systems will act to improve a person’s life through a range of devices, from easy-to-use user interactivity in consumer electronic devices, to intelligent housing for persons with special needs, including persons with disabilities and ageing citizens. Intelligent control of home and work environment parameters (temperature, lighting) besides improving comfort will reduce energy consumption and contribute to health and wellness. Advanced factory integration through robotics and extensive use of information processing for process control will increase productivity of European industrial system, improving safety and enabling new business models. Europe has already now a leading position in the field of equipment automation and robotics, which projects should aim to reinforce.

Targeted approach

Large scale projects are targeted that could start within the first year in these areas, developing basic technology until demonstration in a real environment, involving the cooperation of user companies. These main projects should show both vertical integration with the final user and with equipment, materials and design providers and horizontal cooperation to build a solid technology base for Europe and establish standards.

It is expected that the back-bone of the projects will be formed by large companies, which will stimulate and organize the participation of SMEs and be supported by Research Centers and Universities. The large scale projects could be complemented by a cluster of smaller focused projects, also through calls in a second phase, with larger SME contribution. Synergy must be established with other Sub-Programmes for the development of a common cross functional technology base.

Possible topics of projects

- Reliable and cost effective home environment control (temperature, humidity and lighting) technologies.
- Sensor networks for ambient intelligence and domotic applications
- Interactive multi-media electronics for access to e-services and enhanced inclusion
- Identification media for access to services and e-government solutions.
- Advanced robotic systems for fab automation
- Sensor networks for environment monitoring.
- Wireless or wireline communication systems for electronic integration at home or in the work environment.

Indicative resources

project size in the range of 100-200 person year, over 3 years

2.7 SP7 - Design Methods and Tools for Nanoelectronics

Introduction

This Sub-Programme is one of the two cross-functional Sub-Programmes, together with SP8 “Equipment and Materials” that aim to build the basic technology base for all application-specific technology development. With the increasing complexity of Nanoelectronics devices, both in terms of sheer number of components, and in term of functionalities, design complexity is growing exponentially, and it is increasingly asked to take care of problems like device variability and degradation, noise and functional verification that cannot any longer be fully solved by technology alone. Being a crosscut technology, the impact of Design Tools and Methodology is felt mainly through its effects on innovation and productivity. The efficient use of TCAD platforms (for equipment, process, device and circuit simulation) is expected to provide a 40% cost reduction in technology development for 2007[3]

Target activities

Short and mid term activities are required to enable the efficient design of advanced components, Systems on chip, Systems in a Package and compact miniaturized electronic (sub) systems.
Industrially driven projects for Design Methods and Tools for Nanoelectronics will address the areas of:

- **More Moore**: the development of a deeper physical understanding of transistors and memory cells is needed to handle the problems of complexity and power consumption. Design will help to overcome the problems of variability and reliability of deep submicron CMOS that cannot be solved by technology alone. To enable this, TCAD tools are required which predict the impact of process variability on circuits and design parameters, and allows taking into account also all parasitic effects that are enhanced by the scaling of physical size. New device architectures, which are being proposed to solve the power dissipation problem, like SOI, new substrate materials, new transistor and memory architectures must also be properly modeled.
- **More than Moore**: the large spectrum of new non-digital functions added on silicon requires the development of new modeling and design tools to cover not only the already known fields of high frequency, power and analogue, but also sensors and actuators, which involve micro- and nano-mechanics and fluidics. Since a tight integration in the package of sensors, analogue interface and control logic is required, multi-physics and multi-scale modeling and design tools have to be developed.

Synergy with other priorities

Being an enabling Sub-Programme, SP7 “Design Methods and Tools” interacts with all other Sub-Programmes. Especially important synergies are on:

- Low power design, especially with SP1 “Health” and SP5 “ Communications”
- Design for reliability, especially with SP2 “Mobility” and SP3 “Energy and Environment”
- Design for 3-D integration, with all application Sub-Programmes.
- Device modeling of new substrates and architectures, especially in combination with SP2 and SP3 for high power devices, with SP5 for high performance deep submicron CMOS on SOI and with SP8.

Expected impact

Europe has a strong position in the modeling, simulation and design of complex IC systems, well distributed among industry, including SME’s, research centers, and Universities. There are more than 300 among fabless companies and Design Houses in Europe, for yearly revenues of around 1 B$. Europe does not have any large EDA industry, but several small initiatives are present, mostly originated as start-up from Universities and Research Centers, and major US EDA vendors have development centers in Europe, often derived by the incorporation of European start-ups. The transition from Microelectronics to the emerging

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[3] ITRS Winter Conference, Makuhari, Japan, Dec. 2007

world of Nanoelectronics, with 'More Moore', 'More than Moore', 'Heterogeneous Integration', and 'Beyond CMOS' domains, will open up many opportunities for European Industry, provided it is able to retain and capitalize its leading position on the cross-cutting issues of modeling, simulation and design. *Being a crosscut technology, the impact of Design Tools and Methodology is felt mainly through its effects on innovation* in terms of design cost and time to market. Design efficiency will become more and more a differentiator in the competitiveness of the Semiconductor industry and System houses, and EDA is key to overcome this challenge.

The growing “design gap” between the technology performances made available by the Moore’s Law and the designer capability at exploiting the potential of complexity, is further increased by the appearance of added functionality offered by “More than Moore” technologies and in-package integration. The development of a comprehensive set of Design Tools and Methodologies, including TCAD, is a necessary requirement for the European Industry, to be able to deliver value-added devices needed by main application fields.

Targeted approach

It is expected that the topics of the Sub-Programme would be covered by large scale projects, with a broad industrial participation, A critical mass is required to provide solutions that could be widely deployed in the European scenario, and to achieve a large degree of standardization in order to provide user friendly tools and methodologies that can be used also by smaller design companies and reduce costs. The cooperation of user companies (IDMs, fabless), design centers and CAD tool developers, universities and institutes in the projects will contribute to build a solid electronics design base for Europe and establish standards.

More focused and speculative projects, aiming at the exploration of new approaches, with larger academic participation will be better addressed by regular FP7 calls.

The projects could offer space to the growth of specialized EDA start-ups, also through the aggregation of smaller focused projects on the main ones.

Synergy should be established with other Sub-Programmes, since the design is an integral part of all electronics products.

Possible topics of projects

- **New modeling and simulation capabilities** to support accurate circuit/system (up to SoC and SiP) analysis of physical effects in advanced CMOS technology, both in bulk and on SOI, including thermal effects, substrate currents, electromagnetic noise in bulk and SOI technologies.
- **Multi-scale, multi-physics modeling** and design tools for heterogeneous integration, to deal with sensors and RF integration in multi-chip packages.
- **Design for power management**, aiming at the development of low power circuit design solutions, as requested by mobile applications, covering both static and dynamic power consumption and innovative device conceptions (e.g. SOI, new substrates, innovative device architectures).

Indicative resources

project size in the range of 200-300 person year, over 3 years

2.8 SP8 - Equipment & Materials for Nanoelectronics

Introduction

The activities in R&D for manufacturing, equipment and materials have to strengthen the capability for Europe to maintain and develop a profitable and consistent manufacturing base of key strategic relevance both in economic and political terms. They will need to strengthen the semiconductor companies, giving access to the most advanced manufacturing methodology and allowing equipment and material companies to play a significant role in global alliances and in developing local ecosystems. A high level of co-operation is required between the innovators, equipment manufacturers and manufacturing organisations. Special attention is also given to the replacement of toxic materials, the reduction of energy and water consumption, and, in general, to reducing the impact of the manufacturing process on the environment.

Target activities

Both short term and mid term research activities are required to enable the European semiconductor component and (sub) systems industry remaining competitive without sacrificing the sustainability of the industry.
Industrially driven projects for equipment and materials will address the areas of:

- Materials and processes for **advanced CMOS technologies (More Moore)**: processes and disruptive technologies for advanced memory concepts, embedded and stand-alone, substrate materials and advanced CMOS device architectures for 22nm and low power, including multi-Gate FET, SOI and other high performance substrates; high-k materials for gate dielectrics, low-k materials for interconnect insulation, advanced device processing equipment and chemicals.
- **Equipment and materials for sub 22nm lithography equipment** based on EUV for the time frame of 2010 to 2013
- **Maskless lithography**; nano-imprint lithography tools and materials.
- **Equipment and processes for beyond 32nm** manufacturing, meeting the most advanced specifications, to keep European equipment manufacturing industry at the leading edge of the technology.
- **Metrology:** enable nanometer scale manufacturing by developing ultra fast, high resolution inspection, review and metrology process control tools. Advanced inspection and analysis tools both for in-line measurements and off-line failure analysis.
- Materials, equipment and processes for "**more than Moore technologies**": processes and disruptive technologies for power and high temperature devices, including new materials like SiC and GaN, materials and equipment for MEMS manufacturing, including low-cost lithography systems, advanced device processing equipment and chemicals
- **Packaging and final testing**: chip-size and multi-chip packaging for footprint and power reduction in mobile applications and for sensor and RF integration. High-throughput testing platform, testing and reliability for known-good-die (KGD) integrated with design-for-test methodologies (DFT) to allow cost effective and reliable SiP integration. New on-chip monitor structures to allow online test and reliability measure during the complete lifecycle.
- **Fab automation and flexibility** increase to improve fab flexibility, equipment effectiveness and reducing environmental impact; Maintaining cost decrease per functions, despite greater variability in technology and product demand.

Synergy with other priorities

Synergies are expected with "design methods and tools for nanoelectronics" (SP7) for coping with variability problems as introduced by process variations in manufacturing.

In general SP8 provides basic technology development for all application Sub-Programmes. Specific technologies and device options will serve certain application areas as e.g.

- Embedded non-volatile memories for automotive and security applications (SP2 and SP3)
- Low power CMOS for wireless communication, medical monitoring and ambient intelligence (SP1, SP5 and SP6)
- Silicon Carbide substrates and devices for power applications (SP2, SP4 and SP6)
- Sensor and 3-D integration for medical and ambient intelligence (SP1 and SP6)

Expected Impact

Innovation in materials, equipment and advanced process and manufacturing activities are key elements for any progress in the semiconductor Industry. Projects will need to contribute to maintain the key position of European equipment suppliers in the global market and to the competitiveness and sustainability of the semiconductor fabrication in Europe.

Continuous investments and support to the semiconductor industry in Europe have helped in building a strong European supply chain, from material suppliers to equipment manufacturers. In the semiconductor equipment market we have leading positions with international competitiveness in the areas of lithography in the Netherlands (number one world-wide supplier with net sales of 3.8 billion € and 60% market share n 2007), and in the area of optics, metrology and e-beam patterning as well as III-V semiconductor processing in Germany. As far as materials are concerned, there are three international semiconductor substrate suppliers in Europe, including the number one company for Silicon-on-Insulator substrates in Grenoble.

Technology evolution for scaling of nanoelectronics devices and circuits is facing difficult challenges and a tremendous increase in cost. This forces IDMs in Europe to form worldwide alliances giving away part of intellectual property (IP) or outsource manufacturing to other places of the world eventually becoming fab-lite or fabless companies. Through this ENIAC priority, Europe will mobilize and support IDMs, semiconductor and information technology industry, technology development labs, equipment manufacturers, research centers and universities to further develop the technology for mainstream scaled devices and circuits which will allow maintaining competence in both manufacturing and IP in Europe.

Targeted approach

Equipment development projects in this field will require a tight co-operation between equipment manufacturers and manufacturing organisations, for solutions to be made available that support the quick and cost-effectively introduction of new products on the European market and increase the competitiveness of European manufacturing industry. Projects can involve different levels of the supply chain, offering opportunities for high tech SME's. There is also the potential for multiple equipment makers to work together to resolve integrated processing issues that may effect the advanced line operation and of co-operative initiatives whereby different industry sectors work together.

Projects could be small or large in terms of consortium size, cost or duration targeting fast return or longer term capability development. The large scale projects must target to involve the main actors in this field including large companies, IC manufacturers and Equipment and Materials suppliers, which will stimulate and organize the participation of supporting SME's and Research Centers and Universities. These projects will be complemented by and open the way to the aggregation of smaller targeted and focused projects, if their suggested R&D content is significantly supportive to achieve the goals, with a large potential for SME contribution.

Possible topics of projects

- Substrates, materials and processes for advanced CMOS technologies, process options and derivatives
- Disruptive technologies for advanced memory concepts, e.g. non-volatile memories
- EUV lithography equipment and processes for sub 22nm patterning
- Maskless lithography equipment and processes for beyond 32nm manufacturing
- In-line ultra fast, high resolution metrology for nanometer resolution

- Flexible manufacturing approaches for customized production.
- Testing development for high throughput and advanced packaging.
- 450 mm Equipment & Materials. Advanced work for the preparation of the introduction of 450 mm wafer size, specifically regarding wafer handling, wafer stages, non-scaling processes and metrology on the equipment area and wafer size scaling effects on the material supply area.

Indicative resources

project size in the range of 200-500 person year, over 3 years

3 Requirements for the submission of proposals

A proposal should satisfy the following requirements:

i. Each proposal should address at least one Target Activity and one Sub-Programme and clearly identify which have been addressed.

ii. All projects to be supported will be expected to identify, at proposal stage, their intended contribution to the achievement of the ENIAC SRA and AWP targets. Proposals should describe how projects would measure their contribution and how they would establish a baseline and thereafter monitor their progress compared with the baseline.

iii. All projects are expected to have a strong industrial focus and present a realistic context for industrially relevant, short to medium term research and technology development, and to enable its validation. All projects should demonstrate their expected industrial, social or economic impact.

iv. Clear expression of the technical approach to the research objectives will be essential.

v. All projects to be supported will be expected to share requirements and emerging results, during project execution, so as to achieve the coherent, synergistic progress sought by the ENIAC JU. All projects should demonstrate their possible synergy with other priorities, target initiatives or Sub-Programmes.

vi. Project consortia must be balanced. Considering the explicit involvement of SMEs and favoring clustering of SMEs in innovation eco-systems is encouraged.

vii. In view of the downstream research focus of the ENIAC JU and the targets described in this document, projects with duration longer than 3 years must provide adequate justification for their duration, relative to the application demonstrators and expected impact they describe.

4 Implementation of Call in 2009

4.1 Call 1 - 2009

- Call title: ENIAC Call 2009
- Identifier: ENIAC-2009-1
- Indicative date of publication: 19th March 2009.
- Evaluation procedure: A two-stage procedure will be followed: applicants must submit a Project Outline (PO), followed by the submission of Full Project Proposals (FPP).
    - Deadline for submission of Project Outlines: 6th May 2009 at 17:00:00 (Brussels local time)
    - Deadline for submission of Full Project Proposals: 3rd September 2009 at 17:00:00 (Brussels local time)
- The submission of an eligible Project Outline **is mandatory** for the submission of a Full Project Proposal.
- The general eligibility criteria as well as evaluation criteria and sub-criteria are set out in chapter 5 of this work programme.
- Indicative timetable:
    - The ENIAC Joint Undertaking will provide the applicants with an assessment of Project Outlines by 5th June 2009.
    - It is expected that the selection of Full Project Proposals for funding will take place in October 2009.
    - It is expected that the negotiations for the selected proposals will start in late October 2009.
- Project agreements: Participants in any project resulting from this call are required to conclude a project agreement.
- Financial contribution of the ENIAC Joint Undertaking to participants in projects: Following the evaluation, selection and award procedures of the ENIAC Joint Undertaking, the ENIAC Joint Undertaking will conclude grant agreements with participants. The financial contribution of the ENIAC Joint Undertaking will be 16.7% of eligible costs incurred by participants to implement the projects.

4.2 ENIAC Call 2009 budget

	Indicative Budget of Call 2009 (€)
ENIAC Joint Undertaking [4]	*37 053 500*
ENIAC member States	*67 370 000*
Total indicative budget of Call	***104 423 500***

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[4] estimated as 55% of the amount committed by ENIAC member States to the budget of this Call.

5 Eligibility and Evaluation Criteria for Proposals

5.1 Eligibility checks

The following eligibility criteria will be checked by the ENIAC Joint Undertaking:

1. Eligibility Criteria for proposals (Project Outlines and Full Project Proposals)
2. Eligibility Criteria for funding of individual participants (ENIAC JU funding and national funding from ENIAC Member States)

5.2 Eligibility Criteria for Proposals

Project Outlines (PO)

A PO will only be considered eligible if it meets all of the following conditions:

- It is submitted using the ENIAC Proposal Service (EPS)
- It is received by the ENIAC JU before the deadline given in the call text for POs.
- It involves at least 3 non-affiliated legal entities established in at least 3 ENIAC member States[5]
- It is complete (i.e. both the requested administrative forms and the proposal description are present).
- It is submitted in English[6].
- The content of the PO relates to the topic(s) described in this work programme.

Full Project Proposals (FPP)

An FPP will only be considered eligible if it meets all of the following conditions:

- The corresponding PO has been considered eligible by the ENIAC JU
- It is submitted using the ENIAC Proposal Service (EPS)
- It is received by the ENIAC JU before the deadline given in the call text for FPPs.
- It involves at least 3 non-affiliated legal entities established in at least 3 ENIAC member States.
- It is complete (i.e. both the requested administrative forms and the proposal description are present).
- It is submitted in English[7].
- The content of the FPP relates to the topic(s) described in this work programme.

5.3 Eligibility Criteria for funding

1. The ENIAC JU will carry out the verification of participants against the pre-defined Joint Undertaking eligibility criteria for funding as set out in the financial regulation or published in the Call, on the basis of verifications carried out by the Commission. These verifications will be performed as much as possible before applicants submit a Full Project Proposal.

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[5] Currently: (Austria, Belgium, Czech Republic, Estonia, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, the Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden and the United Kingdom)

[6] Except for the additional information and forms that may be requested by ENIAC member States for the verification of eligibility of national funding that can be in their respective national languages

[7] Except for the additional information and forms that may be requested by ENIAC member States for the verification of eligibility of national funding that can be in their respective national languages

2. The ENIAC JU will carry out the verification of participants from ENIAC member States and their contribution to the project proposals, on the basis of verifications carried out by the respective national authorities, against the pre-defined national eligibility criteria for funding as published in the Call. The verifications by national authorities will be done as much as possible before applicants submit a Full Project Proposal.

The full details on the eligibility criteria for funding will be published in the Call.

5.4 Evaluation criteria

Project Outline

The Project Outline will be assessed by the ENIAC JU, on the basis of the following criteria:

- Relevance will be considered in relation to the topic(s) of the work programme open in a given call and to the objectives of a call.
- Relevance and contribution to the overall ENIAC targets listed in section 3.
- Soundness of the concept
- Clarity and quality of the objectives and expected results
- Contribution, at the European and/or international level, to the expected impacts listed in the work programme under the relevant sub-programme
- Degree of application innovation in the context of the sub-programmes addressed
- Expected market impact of the results for the industrial partners
- Quality of the consortium as a whole including complementarities, balance and involvement of SMEs

Full Project Proposal

The evaluation criteria against which proposals will be judged are set out in the document ENIAC-PAB-4-08: "ENIAC Joint Undertaking selection and evaluation procedures related to Calls for proposals".

The 5 evaluation criteria are:

1. Relevance and contributions to the objectives of the Call.
2. R&D innovation and technical excellence.
3. S&T approach and work plan.
4. Market innovation and market impact.
5. Quality of consortium and management.

Evaluation scores will be awarded for each of the five criteria, and not for the sub-criteria. Each criterion will be scored out of 10. Criteria 1, 2, 3, and 5 will have a weight of 1 and criterion 4 will have a weight of 2. The threshold for the individual criteria (1), (2), (3), (4) will be 6. There is no threshold for the individual criterion (5). The overall threshold, applying to the weighted sum of the five individual scores, will be 40.

Some further explanation on the evaluation criteria:

1. Relevance and contributions to the objectives of the Call.
    - Relevance will be considered in relation to the topic(s) of the work programme open in a given call and to the objectives of a call.
    - Relevance and contribution to the overall ENIAC targets listed in section 3.

2. R&D innovation and technical excellence.
    - Soundness of the concept
    - Clarity and quality of the objectives and expected results
    - Progress beyond the state-of-the-art.

3. S&T approach and work plan
    - Quality and effectiveness of the S&T methodology
    - Quality of the work plan.

4. Market innovation and market impact
    - Contribution, at the European and/or international level, to the expected impacts listed in the work programme under the relevant sub-programme
    - Market impact and quality of the exploitation plans of the industrial partners; quality of the market analysis section including competitor descriptions and market opportunities.
    - Appropriateness of measures for the dissemination of project results.
    - Contribution to standards.
    - Management of intellectual property.

5. Quality of consortium and management[8].
    - Appropriateness of the management structure and procedures
    - Quality and relevant experience of the individual participants
    - Quality of the consortium as a whole including complementarities, balance and involvement of SMEs
    - Appropriateness of the level, allocation and justification of the resources to be committed (budget, staff, equipment)

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[8] This evaluation criterion corresponds to the **selection criteria** in the meaning of the general financial regulation (article 115) [OJ L 248, 16.09.2002, p. 1] and its implementing rules (article 176 and 177) [OJ L 357, 31.12.2002, p.1] and of the financial rules of the Joint Undertaking (article 101). It will also be the basis for assessing the 'operational capacity' of participants. The other four evaluation criteria (1-4) correspond to the **award criteria.**

6 How to submit a proposal

Proposals should be submitted in accordance with the terms set out in the call for proposals. In order to submit a proposal, applicants should consult the following documents:

- The text of the call for proposals, as announced in the Official Journal of the European Union and published on the webpage of the ENIAC Joint Undertaking
- This Work Programme
- ENIAC Eligibility criteria
- The Guide for Applicants

7 References

There are also a number of other useful texts which applicants could refer to:

AENEAS Articles of Association (http://www.eniac.eu)
Council Regulation 72/2008 (http://eur-lex.europa.eu)
ENIAC Multi-Annual Strategic Plan
Strategic Research Agenda of the European Technology Platform ENIAC (http://www.eniac.eu/web/downloads/SRA2007.pdf);
White book of Eureka cluster CATRENE: (http://www.catrene.org/web/calls/whitebook2.php)