



**SEMI® WHITE PAPER**

# **6 Recommendations to the European Union and National Governments to Increase Europe's Microelectronic Industry Competitiveness**



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### ABSTRACT

The semiconductor industry has been a key contributor to European economic growth and prosperity, and an important enabler of European success in the communications, consumer electronics, industrial machinery, and automotive industries. The semiconductor industry will also provide solutions for the important issues in our society and serve as the foundation for progress in energy conservation, renewable energy, transportation, telecommunication, biotechnology, medical, and many other fields. Semiconductors are critical to European industry and welfare and must be prioritized to keep the European industry competitive.

The EU and some of its member states recognize the strategic and economic value of the semiconductor industry and proactively support the sector by initiating R&D programmes such as the EU framework programmes and Eurêka, with specific funding lines for semiconductor-related R&D (SEA, ENIAC, JESSI, MEDEA or CATRENE).

In spite of these enormous efforts, the European semiconductor base is shrinking and more and more companies are choosing to outsource device manufacturing to other regions, mainly to Asia. At the same time, governments in other regions continue to strongly support the semiconductor device makers by providing significant incentives, R&D funding, workforce development programmes, and a favourable regulatory environment.

SEMI Europe members as suppliers of equipment and materials to the semiconductor industry are concerned by this development. Although system integration, R&D and small scale production might still remain in Europe, SEMI Europe members fear that without major semiconductor manufacturing, eventually knowledge-based activities will also relocate to other regions—with severe consequences for Europe's competitiveness. To keep Europe in the technology race, SEMI members urge the EU institutions and the member states to reinforce their commitment to the industry now by committing to the six SEMI recommendations listed in this White Paper. As a result, Europe will continue to create high value-added jobs, contribute more to the GDP, and allow the advanced semiconductor equipment and materials industry to compete in the global economy.

### ABOUT SEMI

SEMI is a not-for-profit global industry association, representing the suppliers of equipment and materials used to manufacture semiconductors and many high tech technologies (photovoltaic, flat panel display, MEMS, etc.). SEMI has over 2,000 member companies worldwide, of which 11% are located in Europe. SEMI supports industry growth through advocacy, international standards, expositions, and industry research. For more information, visit [www.semi.org](http://www.semi.org).

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## EXECUTIVE SUMMARY

In the last decade, about 35 billion Euros were invested in the European semiconductor industry to keep pace with the worldwide development of information and communication technology (ICT) products. Today, no industry sector is competitive without using advanced microelectronic devices. These devices are the backbone of today's innovation enabling many new products from consumer products to industrial application, automotive, telecommunication, medical, office automation and more. These are all sectors where Europe plays or can play a global leading role. In addition, silicon-based products are the raw materials needed for renewable energy, such as solar cells, which helps reduce our energy consumption.

Microelectronics is the driving force for technologies in all industries. These technologies help deal with important societal challenges such as climate change, energy shortages, security issues, and health. In recent years, the European competitiveness in semiconductor has diminished. Europe is facing tough foreign competition from Asia, market share erosion, and challenges to its technology base.

Europe is also not always successful in quickly transforming R&D results into product commercialization. Billions of Euros are spent every year on R&D, but the results on job creation and growth are limited and more and recently more jobs are being created overseas to manufacture products invented in Europe. Both, Liquid Crystal and MP3 technology were originally developed in Europe and commercialized in Asia. At the same time, the Flat Panel Display industry is a US\$ 100 billion market and completely dominated by Asian companies.

Government and industry both seek to maintain our innovation leadership position in specific application fields and keep Europe's semiconductor manufacturing infrastructure strong for future generations. We must work together to secure the future.

Recently, a number of reports on the challenges and opportunities faced by the electronic industry<sup>1</sup> and more particularly by the semiconductor sector have been presented to public authorities. This white paper does not aim to repeat issues already discussed. Rather, the white paper builds on recommendations made in those reports and focuses attention on the challenges and opportunities facing the semiconductor equipment and materials industry. Its purpose is to send key messages to public authorities and engage in an urgent and intensive dialogue with all stakeholders.

<sup>1</sup> The list can be found in the sources listed on page 15, at the end of this white paper.

## Why Does This Industry Matter?

The semiconductor supply chain is critical to the European and our global competitiveness. The industry's products and services—and the end products they make possible—result in increased economic productivity, higher skill jobs, enhanced national security, and better healthcare.

- **A Strategic Enabling Industry:** Advanced semiconductors provide "embedded intelligence" to all other technology products. Without semiconductors and the equipment and materials to build them, no leading or emerging industry (such as automotive, aerospace, energy, telecommunication, medical equipment, etc.) can remain competitive in the future. If Europe loses the ability to develop and produce advanced semiconductors, our industries will mostly be dependent on foreign supply, which could be an EU risk.
- **Jobs:** The semiconductor equipment and materials industry employs close to 105,000 people in Europe, adding to 110,000 employees in the semiconductor industry itself. The industry maintains facilities in more than 10 European countries with a significant presence in Germany, France, Ireland, United Kingdom, the Netherlands, Italy and Austria.
- **Market Share of Semiconductor Equipment and Materials:** In 2007, the size of the global semiconductor equipment and materials market was US\$ 86 billion. The market share for Europe was 8%, resulting in a US\$ 7 billion contribution to the European GDP. If the decline of semiconductor manufacturing continues, the equipment and materials market may be jeopardized.
- **Market Share of Semiconductor Devices:** In 2007, the size of the global semiconductor device market was US\$ 257 billion (WSTS). The market share for Europe resulted in a US\$ 41 billion contribution to the European GDP (WSTS). However, even if the European market is still growing in value and units (in US\$ terms), its global share is declining from 21% in 1997 to 16% in 2007.
- **Technology Development Leadership:** Europe's microelectronics companies are among the world's leading companies in the development of advanced semiconductor technologies and materials, including nanoelectronics, micro-electro-mechanical-systems (MEMS) and photovoltaic. The speed of innovation and time-to-market in the semiconductor industry is unprecedented and sets the pace for all other industries.

## 6 RECOMMENDATIONS TO KEEP EUROPE COMPETITIVE

### 1 Develop a European Vision for the Industry

The EU and national political leaders need to maintain and build up Europe's competitiveness and global innovation leadership in semiconductors. To keep the equipment and materials industry healthy in Europe requires a competitive semiconductor device infrastructure, including R&D funding, fostering science and technology talent, enforcement of IP and its protection, and industry involvement in EHS legislative decisions. These requirements are necessary for the industry's development in both major technology trends currently driving the semiconductor industry: "More Moore" and "More than Moore", which will be described further in the white paper.

SEMI Europe members and future generations of European citizens need the EU's commitment to these issues NOW. To secure the knowledge and manufacturing base in Europe, the entire semiconductor ecosystem needs to develop a pan-European industry vision and identity, and then demonstrate the leadership needed to make it happen. More intensive coordination between the EU and the member states could result in a better focus, avoiding redundancy and concentrating on the best of breed projects with the highest chances to deliver world class results, competitiveness and higher employment and GDP contribution. Let's work together to keep the microelectronic supply chain, R&D and device manufacturing in Europe.

### 2 Increase Funding for R&D and Manufacturing

To keep European semiconductor manufacturing infrastructure and technology competitive, the EU and national governments must increase public funding in both the "More Moore" and "More than Moore". Other regions are creating new funding models and subsidizing both R&D and manufacturing. Staying on track with Moore's Law (smaller geometries and bigger wafer size) requires funding beyond the 10–15% that semiconductor equipment and materials companies traditionally invest. According to a SEMI study, the R&D funding gap between what is required for the equipment and materials industry and what can be financed will amount to US\$ 5.8 billion by 2010<sup>2</sup>. By increasing R&D funding (within the Lisbon Agenda), Europe can fill this gap for developing the next generation of IC technology (< 22nm / 450 mm wafer size). In addition, a consolidation of R&D initiatives on EU and the national level could help accelerate development and increase efficiency of the funds currently deployed.

### 3 Promote the Microelectronics Supply Chain

- **Create Industry Incentives:** Countries all over the world, especially in Asia, recognize the need for strong government support including: tax exceptions, R&D credits, low cost facilities, and investment aids. Many countries currently grant incentives to keep or expand the local semiconductor industry, and others actively recruit and acquire foreign investment. To maintain and entice semiconductor-related companies to Europe requires incentives to help compensate for the plethora of incentives in other world regions. SEMI Europe

members urge the EU Institutions to grant competitive incentives for European semiconductor and supplying companies and foreign investors. SEMI Europe strongly recommends identifying new funding models to maintain and grow manufacturing in Europe.

- **Promote Existing Semiconductor Industry Clusters:** The recent decades have proven that companies in clusters increase their chances of becoming competitive and that semiconductor-related knowledge and business opportunities are enhanced. Several semiconductor industry clusters (like in Saxony, Grenoble, and the triangle Eindhoven/Nijmegen/Leuven) have critical mass regarding semiconductor knowledge and manufacturing. Based on the German government initiative to focus funding on selected "Spitzencluster"<sup>3</sup> (top clusters), SEMI Europe members urge the EU and member states to support existing semiconductor clusters by helping them to sustain companies' competitiveness. Actions should be developed with the cluster actors, based on an analysis of their strengths and weaknesses, and benchmark between them. To maximise synergies and collaboration throughout the industry, cooperation with clusters from other industries using semiconductors should be encouraged.
- **Adopt the EU Small Business Act:** Besides large semiconductor device and equipment manufacturers, smaller fabs and semiconductor manufacturing equipment companies in Europe are an essential part of the microelectronic ecosystem. The large companies need a strong supplying base, essentially consisting of small and medium size companies (SMEs), and vice versa. It is critical that the EU and the member states adopt the legislative and incentive measures proposed in the Small Business Act, keeping in mind that the European semiconductor equipment and materials industry consists 88% of SMEs.
- **Support Dedicated Fabs to Create Devices Necessary for New and Emerging Applications:** Many smaller fabs have emerged in Europe. They offer a wide range of high-value semiconductor-related products, used in new and emerging applications. These fabs, operating in the "More than Moore" domain, use mostly "second-to-last" technology nodes but they show consistent over-average growth. Due to the smaller volume and proximity to the customer, these markets are less likely to get relocated into other regions. Europe can win the global race in this industry segment. That's why SEMI Europe members recommend that the EU and member states support this segment by strengthening R&D and by promoting the development of new and emerging applications. Many proposals can be found in the recently published Electra<sup>4</sup> and FIEEC<sup>5</sup> reports on the future of the European electrical and electronics industry, which request policy

2 SEMI—Semiconductor Equipment and Materials: Funding the Future, SEMI white paper, October 2005.

3 *Deutschlands Spitzenclusters—Mehr Innovation, Mehr Wachstum, Mehr Beschäftigung*, BMBF, 2007.

4 *Electra Report "Twenty Solutions for Growth and Investment to 2020 and Beyond"*, 10 June 2008.

5 *FIEEC "Une Stratégie Industrielle pour les Marchés du Future—La Croissance Se Construit Ensemble"*, June 2008.

actions on applications and markets where Europe is or can be a leader (environment, energy efficiency, electronic security, transportation, e-health, etc.).

- **Establish a Favourable U.S./Euro Exchange Rate:** The EU Council should make full use of its powers to establish an exchange rate policy and negotiate with the USA authorities about a Euro/U.S. dollar exchange rate more favourable to EU exports. The currency exchange rate must not be distorted anymore, as sudden appreciation of the Euro against other key currencies in the world puts the European microelectronics supply chain in jeopardy. Currency disparities and fluctuations per se are a normal consideration for globally operating industries. However, the current successive, all too rapid deterioration of the currency exchange rates of the Euro vs. the USD over short periods of time is jeopardizing Europe's competitive position. The impact of currency fluctuations on the industry, and the extent to which fast and continuing one-direction currency fluctuations have undesirable effects on economies cannot be underestimated. There are no significant medium-term to long-term economic or political winners in this game for any region. Such rapid one-directional fluctuations are likely to undermine profitability particularly at any European-based company. But a fluctuating currency market over which companies have limited control is affecting more than fiscal results; it is also skewing competitiveness.

#### 4 Cultivate Education and Welcome Talent

Europe is suffering from skilled-labour shortage, particularly in the ICT sector which lacks 300,000 qualified staff<sup>6</sup>. In order to fill the staffing gap, two actions are needed: attracting more students in the fields of natural science, mathematics and engineering, and welcoming highly-educated foreign nationals to Europe. Further actions are required both at EU and national level to ensure that Europe can still compete in the global race for talent. Existing private initiatives such as the SEMI High-Tech U should be given public support.

<sup>6</sup> "Women Wanted in Europe's ICT Industry"—European Commission press release of 6 March 2008.

#### 5 Protect and Enforce Intellectual Property

The semiconductor industry depends on intellectual property (IP) to keep innovation alive, but IP offences such as patent infringement, counterfeiting, and trade secret theft have reached serious levels. IP protection is critical to allow the semiconductor supplier base to invest in the R&D necessary to continue technological advancement and survive in the global electronics supply chain. Based on a SEMI white paper of April 2008, *Innovation at Risk—Intellectual Property Challenges and Opportunities*, which outcomes are described further in the white paper; SEMI Europe urges the EU institutions to work with trading partners to ensure that they have effective IP protection and enforcement policies, and that they adhere to their IP commitments. Within the EU, an effective EU patent scheme has to be proposed and adopted.

#### 6 Involve SEMI Europe in New EHS Legislation

Environmental Health and Safety (EHS) issues are important to the semiconductor equipment and materials industry. Over the years, the industry has proven its commitment to sustainability as well as its proactive stance on protecting the global environment. SEMI members have demonstrated their commitment by developing their own self-regulatory instruments such as the SEMI Global Care Program, SEMI standards and many other initiatives, notably in collaboration with the World Semiconductor Council (WSC). Some EHS regulations can be extremely technical and far-reaching in scope, with a chilling effect on the micro-electronic industry. This is particularly the case for the REACH regulation, the PFOS or the RoHS directives. As new EHS legislation is proposed, the EU and governments need to include the industry (via SEMI members) in the official review process. Consulting with SEMI Europe at the earliest possible stage of new EHS legislation will help identify the best EHS solutions for the environment and for industry, while considering global competitiveness and implementation issues.

All of the above recommendations are presented in more detail in this White Paper.

## I DEVELOP A EUROPEAN VISION FOR THE INDUSTRY

### A Strategic Enabling Industry

In all developed and emerging countries, the semiconductor industry and its equipment and materials suppliers are viewed as a strategic sector. Considerable amounts of private and public funds are invested in the development of this sector. Semiconductors are the engine of the entire electronic and ICT food chain, and they are pervasive in all sectors of industry and the development of nano-electronics. Semiconductors have become a driving force for all technology solutions that can answer crucial societal challenges such as climate change, energy shortage, security issues, or healthcare for aging populations.

It is estimated that 1 Euro invested in the semiconductor and supplying industry generates 3 Euros in products and services. The \$86 billion semiconductor equipment and materials industry forms the basis of a reversed pyramid that contributes to the creation of a semiconductor market worth US\$ 256 billion. In turn, the semiconductor market contributes to the electronic products market (worth US\$ 1,580 billion), and to the electronic services market (worth US\$ 6,500 billion<sup>7</sup>).

Moreover, the "pervasion" of semiconductors in all industry sectors and the central role of ICT in all emerging industry areas make the equipment and materials industry a fundamental building block of the European knowledge-based economy.

SEMI Europe members strongly believe that new and emerging sectors will require more and more semiconductors, and consequently more equipment and materials. A new growth era is beginning, where the providers of technology solutions will be global leaders. Europe is in a position to become a global leader if the right decisions are made.

### Europe is Losing Ground in Semiconductor Manufacturing

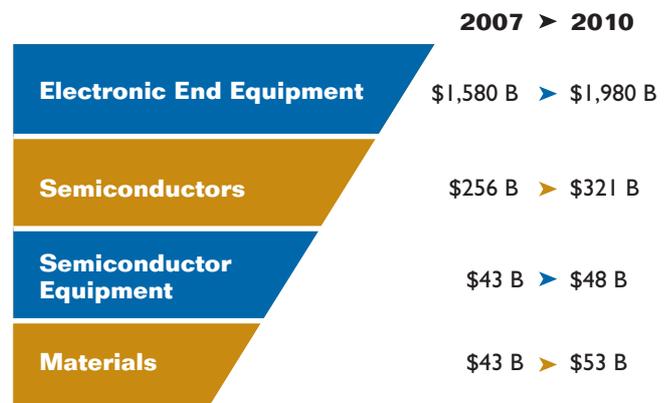
For decades, Europe has been in third place for both manufacturing and consumption of semiconductors as well as equipment and materials, after the USA and Japan.

But this position is eroding: in 2005, Europe's semiconductor consumption was estimated to be 20% of global sales, and its production capacity of 12% of the world<sup>8</sup>. In 2007, the production capacity was estimated to be less than 10% of the world (due to large investments in other regions), with less consumption (estimated to 16 to 17%, due to less electronic applications production in Europe).

7 2007 Strategic Research Agenda, European Nanoelectronics Initiative Advisory Council—ENIAC, 2007.

8 2007 Strategic Research Agenda, European Nanoelectronics Initiative Advisory Council—ENIAC, 2007.

### The Electronics Ecosystem



Source: SIA, SEMI, and Henderson Ventures, March 2008

SEMI members in Europe observe with growing concern that their European customers are gradually leaving the continent, mainly for Asia, thus weakening the development of a still strong supplying industry and thousands of SMEs at the core of Europe's most innovative industry. SEMI estimates<sup>9</sup> a production value of over 9 billion Euros of the equipment and materials market in 2008 in Europe, not including the secondary market that consists of vendors and service provider to the primary market.

Of course, European semiconductor equipment and materials manufacturers are exporters and consider the world as their market. But, as a sector essentially composed of SMEs and start-ups, they need a strong semiconductor manufacturing and research base in Europe to continue growing on the global market and exporting their technologies.

This is becoming even more important as they face growing competition in countries like Taiwan and Korea. These countries have traditionally relied on equipment from the USA, Japan and Europe. However, in recent years, they have strongly invested in building their own supplying industries, closing the gaps in the production chain. Proximity to large customers like Samsung (Korea) and TSMC (Taiwan) provide a comparative advantage to semiconductor equipment and materials manufacturers from those countries.

9 2007 Strategic Research Agenda, European Nanoelectronics Initiative Advisory Council—ENIAC, 2007.

### **Need for a European Consolidated Vision**

Like the other regions, Europe is faced with global structural issues such as rising energy costs, ageing populations, and the need to increase productivity to compete on a worldwide level. To cope with these challenges, the role of electronics and information systems as solution providers will increase. Citizens everywhere expect better health systems, safer cars, improved energy management, improved telecommunications and information access, better entertainment and security. All sectors require increasing numbers of high-value semiconductors and equipment and materials. These societal needs represent enormous technology and business opportunities for Europe.

To maintain or acquire leadership in these expanding new markets will require leadership in the semiconductor device and equipment and materials supplying industries. The challenge is daunting: to address these new leading markets—becoming the worldwide market leader in a number of these domains and

heavily investing in R&D and supporting infrastructures. It also requires Europe to urgently address and solve its fundamental weakness in transitioning R&D into commercial products.

Even in markets well established in Europe, such as the automotive industry, automated manufacturing or medical equipment, semiconductors play an ever-increasing role. It can be argued that a close access to semiconductor devices is crucial in maintaining the competitive edge in these industries.

**Keeping strong semiconductor and equipment and materials supplying industries in Europe is essential. They represent the backbone and the enabler for the entire European economy. An internationally competitive Europe depends on the presence of a strong European semiconductor industry, which allows industries like automotive, communications, biotechnology, energy or engineering equipment to produce more effectively and to innovate faster.**

## 2 INCREASE FUNDING FOR R&D AND MANUFACTURING

Since the mid-1960s, a general trend has driven the semiconductor industry: Moore's Law, based on the prediction by Intel co-founder Gordon Moore that the number of transistors on a semiconductor will double approximately every two years. As a consequence, the cost per transistor on a semiconductor is cut in half every two or three years. This trend continues to develop under the "More Moore" research and application domains and now is developing into the nano-electronics area. However, miniaturization is reaching the limits of the atom scale with growing physics and technology issues—requiring higher investment costs in R&D and manufacturing. The cost of a modern (300mm) semiconductor fab has risen to 5.5 billion Euros.

Annually, the semiconductor equipment and materials industry spends between 10 and 15% of its annual sales on R&D. But the semiconductor industry is evolving at such a rapid speed that higher levels of R&D funding and increased cooperation mechanisms are necessary. At the same time, SME access to these R&D funds must be ensured.

### A Long-Standing Involvement of Public Authorities in Europe

Since the 1980s, the EU and its member states have been proactive in helping the semiconductor and equipment and materials supplying industries with the development of R&D programmes as part of the EU framework programmes or within the Eureka framework (JESSI and its followers MEDEA, MEDEA+, CATRENE). Within the EU framework programmes, the Semiconductor Equipment Assessment (SEA) directly addressed the equipment and materials manufacturers. At the level of the member states, national programmes have also been implemented. According to the website Cistrana<sup>10</sup>, currently 14 major R&D programmes exist at national level. These programmes have in a way helped to address a structural emergency and have helped build a long-term cooperation network in research and technology development.

The recent launch of the ENIAC JTI in the form of a Joint Undertaking provides a strong legal and durable platform to all stakeholders in the area. The future European Technology Institute will also increase public-based R&D sources for the industry.

### Funding Gap and New Research Models

However, industry needs more public funding. According to the Catrene White Book<sup>11</sup>, overall public funding for R&D in semiconductors is about one-third of the average funding ratio for the overall European industry. Moreover, measured against the Barcelona objective of 3% of the EU GDP spent in R&D in 2010, the European semiconductor industry has led in terms of the ratio industry/public funding.

According to the study "Semiconductor Equipment and Materials: Funding the Future" prepared for SEMI in October 2005<sup>12</sup>, by 2010 the semiconductor equipment and materials industry will require an estimated US\$ 16.2 billion of annual R&D funds, while it can afford to fund only US\$ 10.4 billion of this amount. This is a funding gap equal to US\$ 5.8 billion—caused by the major technology challenges confronting the industry, particularly the "More Moore" domain with the need for new materials, process integration, and new generation photolithography.

Increased public funding has to be accompanied by further development of cross-border programmes. These programmes will become structurally more and more important as Europe (and not individual countries) is the base market for the industry's global expansion.

The evolution of the supply chain from linear to a series of multiple interconnected eco-systems has major consequences on the R&D model. It implies that R&D is performed where appropriate partners (including suppliers and customers) and availability of "know-how" are located, and that state support conditions are met. These eco-systems also must integrate SMEs, for which development on global markets depends on larger companies with whom they work. The development of private-public partnerships should be encouraged.

### Increased International Competition in R&D

Most developed and emerging countries outside Europe are heavily engaged in strongly supporting their semiconductor industries: the United States and Japan, South East Asia (Taiwan, Singapore, and Korea), and more recently China and India. There is increased competition on where to do R&D. According to a recent worldwide survey on the question "Are you investing in R&D in Europe?" only 28% of the companies interviewed replied "yes," while 47% declared that they are not investing in Europe and 65% specified that they are investing in Asia. This is a fundamental challenge for the development of the industry in Europe.

### Focus Resources or Encourage Flexibility?

Current EU projects often lack full participation of SMEs, especially compared to the level at which these companies contribute to the European economy. Several explanations are possible, but one of the most obvious is the mismatch between the business cycle of an SME and the cycles of funded programmes. Funded programmes require public calls for tender—with topics defined a long time in advance with the participation of large groups of companies and institutes—to concentrate the scarce resources available. The public process of calls and evaluations also guarantees an open and objective allocation of these scarce resources.

<sup>10</sup> Source: <http://www.cistrana.org/>, Cistrana is a project initiated by a European Research Area (ERA) working group of Member and Associated States.

<sup>11</sup> CATRENE, Cluster for Application and Technology Research in Europe on Nanoelectronics, *White Book*, 2007.

<sup>12</sup> SEMI—*Semiconductor Equipment and Materials: Funding the Future*, SEMI white paper, October 2005.

However, the strength of SMEs lies in their agility and short business cycles. By the time a project gets approved or concluded, the company is often not interested any more, or has found other solutions. In addition, SMEs are much more focused on specific products and markets, so that they have difficulties identifying themselves with generic type of calls and the sometimes abstract nature of consortia objectives.

In order to cope with these challenges, additional vehicles need to be developed that take the needs and characteristics of SMEs into consideration. Initiatives such as the SEA-NET project (Semiconductor Equipment Assessment for nanoelectronic technologies)<sup>13</sup> seem to help circumvent these issues, but these initiatives should be broadened and used more often. If SMEs get a positive experience through these types of projects, they may also consider participating in consortia or other ENIAC and FP7 activities.

<sup>13</sup> <http://www.sea-net.info>

## Improve the R&D System

The semiconductor equipment and materials industry believes that the European R&D system can be improved along the following paths:

- **Decrease the Regional Fragmentation:** While the ENIAC JTI is a step in the right direction, better coordination of all existing R&D programmes at regional, national and European levels is needed. Synergies need to be found, both to decrease costs but also to define common research priorities.
- **450 mm wafer diameter has to be assessed as** the diameter is very controversial. Although the equipment and materials industry in Europe has to develop state of the art technology to be globally competitive, this should not be financed on the costs of other sectors in the "More than Moore" trend (MEMS, etc.). The majority of the European equipment provider will not have the necessary resources to enter 450 mm. It will lead to an oligopolistic market for large quantities (mainly memories) and not address the real needs of the European market which is based on application oriented devices for automotive, telecommunication, automation, medical, etc. These market sectors do not require large wafer diameters.
- **Offer Better Access to SMEs:** Despite the effort made by the European Commission to help SMEs access EU funds on R&D, a large information gap exists. Also, SMEs believe that many (supposed or real) bureaucratic hurdles confront a SME applying for such funds.
- **Implement Concrete Measures, such as:** speeding up funding decisions; allowing a company to make a basic proposal in the initial phase and, upon approval, obtaining funding to develop its full proposal.
- **International Cooperation:** The technology and business challenges the industry is facing are global, so a greater level of sharing resources and risks is needed between the semiconductor manufacturing regions.

### 3 PROMOTE THE MICROELECTRONICS SUPPLY CHAIN

#### Adopt the EU Small Business Act

Based on SEMI membership figures, 88% of semiconductor equipment and materials companies are small- and medium-sized enterprises (defined as US\$ 0–25 million in revenue) as shown in Figure 1. Europe is home to 11% of them (Figure 2).

The structure of the semiconductor equipment and materials industry is very different from the structure of its customers, dominated by large companies. Also, it is nesting many start-ups. This is why specific policy and industry measures must be developed to enhance the sector:

The role of public authorities is crucial to achieve this objective. For many years, the EU has promoted the role of SMEs, particularly with regard to the realization of the objectives of the Lisbon Strategy. The publication of a communication on a Small Business Act (SBA) by the European Commission in June 2008<sup>14</sup> is of particular interest for the equipment and materials manufacturers. In the SBA, the semiconductor equipment and materials industry supports in particular three legislative initiatives on:

- The establishment of a general block exemption on state aid;
- Simplification of VAT invoicing rules;
- Late payments (amending the EU directive of 2000).

Other policy measures would provide a massive boost to the development of SMEs, especially those:

- Promoting access to risk capital, including the financial products of the European Investment Bank and the European Investment Fund;
- Supporting benefit from the growth of international markets, in particular in non-EU Eastern Europe and China, where new markets for semiconductor equipment and materials manufacturers are growing fast;
- Enabling the take up of environment challenges to turn them into market opportunities;

<sup>14</sup> Communication from the European Commission "Think Small First" — A "Small Business Act" for Europe, COM(2008) 394, 19 June 2008.

- Encouraging the management of IP;
- Providing a second chance for honest entrepreneurs having faced bankruptcy.

#### Support Dedicated Fabs to Create Devices Necessary for New and Emerging Applications

Complementary to the "More Moore" domain described in recommendation 2, "More than Moore" consists in adding extra functionalities to the basic semiconductors, by converting non-digital and non-electronic information (mechanical, thermal, acoustic, chemical or optical) to and from the digital domain. This is often described as "putting eyes, ears, arms and legs" to the brain<sup>15</sup>.

The economic model within which "More than Moore" semiconductors are developed is different from "More Moore." It requires less capital investment and can (in many cases) happen by using existing and smaller European fabs, thus increasing their life-time and return on investment. "More than Moore" devices can add value to "commodity" semiconductors which production is less profitable. They are also fundamental for the development of new and emerging applications.

Europe has solid assets to become a world leader in the "More than Moore" trend, such as<sup>16</sup>:

- Excellence of laboratories involved with this domain of research;
- Presence of European leaders in application sectors, such as energy, health & biology, food (tracing of aliments), security (border controls) or transportation. In particular, the MEMS technologies—used as sensors—are a driving innovation force for the automotive industry;
- Close cooperation between semiconductor and application manufacturers;

<sup>15</sup> 2007 Strategic Research Agenda, European Nanoelectronics Initiative Advisory Council — ENIAC, 2007.

<sup>16</sup> Rapport sur l'Evolution du Secteur de la Micro/Nanoélectronique, Sénateur Saunier, 2008.

Figure 1 SEMI Member Company Size

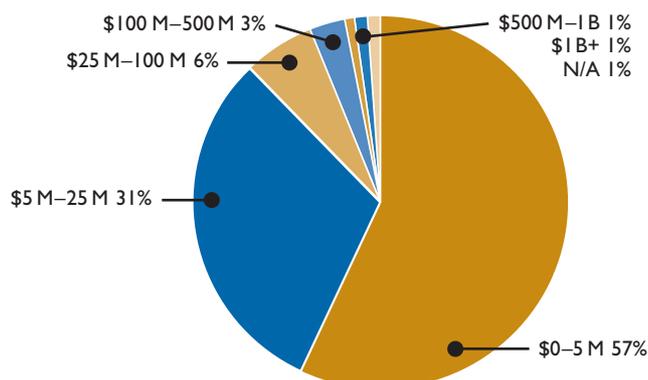
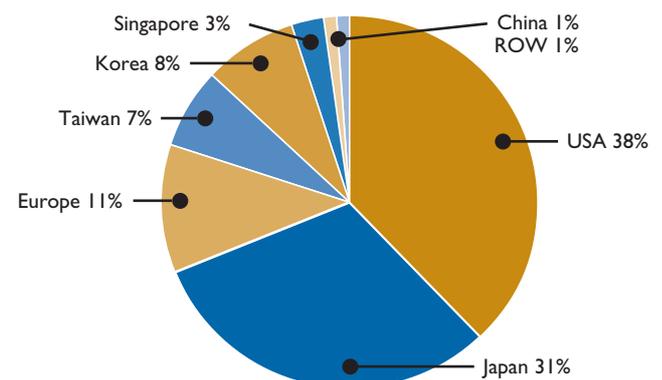


Figure 2 SEMI Member Location of Semiconductor Equipment and Materials Companies



- Development of niche markets for dedicated functions in specific applications: these markets are application driven and could favour the development of European SMEs which have the flexibility to address them.

"More than Moore" also supports the development of breakthrough semiconductor technologies and pulls requirements for new materials and processes, where Europe can further develop its comparative advantage.

However, the development of the semiconductor industry in the "More than Moore" areas requires three conditions:

- First, the development of "semiconductor solutions" can only occur if there is a strong applications market, supported by a network of innovative large companies and SMEs: as an example, organic diodes will only be developed in Europe if there is a strong lighting industry;
- Second, even if existing semiconductor fabs can be used, investment will have to be made to convert them;
- Finally, significant funds will have to be devoted to R&D in 200 mm fabs.

As mentioned earlier, priorities need to be defined but the semiconductor equipment and materials industry strongly believes that there is a vast potential for return on investment from the "More than Moore" domain.

### Create Industry Incentives on the Model of Other Regions

**Amongst all European industry sectors composed of a large majority of SMEs, the semiconductor equipment and materials industry is probably the most engaged in globalisation. It is therefore mandatory for the European manufacturers to compete on the same level playing field as their main competitors.**

According to some industry leaders, the main profitability gap between Europe and Asia comes from the difference on subsidies. These subsidies can have various forms, be direct (tax-credit on research, support to exportation, etc.) or indirect (support to infrastructures, to research, to education, etc.) In recent years, public incentives have been granted to semiconductor manufacturers as well as their equipment and materials suppliers, especially in Asia.

The 2008 report of the French Senator Saunier<sup>17</sup> provides a very interesting description of the ambitious public policies and incentives in place in Asian countries and the USA to strategically support the development of the semiconductor and supplying industry.

In Singapore (6th world semiconductor manufacturer), the government launched a programme in 2005 aiming at doubling the industry's turnover and value added by 2018, based on:

- An increase in the presence of multinational companies, especially those qualifying as "pioneer companies" (most high tech companies qualify) with a long-term exemption of income tax, incentives on investment (including training) and low cost facilities;

- A strict protection of intellectual property;
- The promotion of R&D, based on a doubling of public spending between 2007 and 2012, on priorities set where Singapore can be internationally competitive, and on reinforced interactions between industry and research.

In Taiwan (2nd world semiconductor manufacturer in 2007), the semiconductor sector has been considered as a national priority since the 1980s. This was confirmed with the launch of the "Challenge 2008" programme for the period 2008–2012, and more specifically the Two-Trillion project for semiconductor and flat panel displays. Taiwan has organised itself on the following basis:

- Creation of scientific parks, where universities, industry and research centres are located in the same area. In 2006, the Hsinshu scientific park gathered 194 companies in the micro-electronic area, employing 68,000 people; those parks encourage a strong cooperation between research and industry;
- Promotion of university education tailored to future industry needs;
- Strong financial incentives for companies—especially those in emerging and strategic sectors—investing in R&D, training, equipment purchase, resource conservation and pollution control.

In mainland China, where semiconductor production grew from 2% of the world production in 2000 to 7% in 2007, the sector has been considered as strategic since the 1960s, but the country has always lacked up-to-date manufacturing technology. So far, export controls on semiconductor equipment imposed by the US administration have prevented the Chinese semiconductor industry from manufacturing the most advanced devices. However, Taiwan may revise its traditional policy of only exporting older technology to mainland China and could decide to implement state-of-the-art fabs on the continent. This policy shift would immediately offer a huge opportunity for the development of the Chinese semiconductor industry.

The USA remains a major actor in the semiconductor industry, with nearly 50% of the world semiconductor and 34% of design manufactured by American companies. Support to the semiconductor industry occurs at three levels:

- **Federal:** with the support of agencies such as the National Science Foundation (NSF), the Defense Advanced Research Projects Agency (DARPA) and the Department of Energy.
- **State:** for example, the state of New York, notably, has invested US\$ 2 billion in the creation of the College of Nanoscale Science and Engineering at the Albany University, attracting over 100 microelectronic companies and generating US\$ 7 billion more investments by industry.
- Industry associations such as International SEMATECH, the Global Research Corporation, the Microelectronics Advanced Research Corporation (MARCO) financing the Focus Center Research Program, or the Nanoelectronic Research Initiative.

<sup>17</sup> Rapport sur l'Evolution du Secteur de la Micro/Nanoélectronique, Sénateur Saunier, 2008.

Unfortunately, neither the EU, nor any member state, has developed the political vision and the policy and economic instruments to strategically support the semiconductor and supplying industry. This must be addressed urgently. The European semiconductor equipment and materials industry can only be competitive if it competes in the same local economic and policy environment as the other semiconductor regions in the world.

### Promote Existing Semiconductor Industry Clusters

As mentioned in the FIEEC report<sup>18</sup>, cooperation between large, medium range and small/medium size companies can be a major factor for innovation and the development of new projects. The report provides the example of the software industry where Microsoft promotes the creation of start-ups in their sector (not necessarily financially but by providing advice), or of IBM's Eco-patents Commons programme, where patents related to sustainable development can be shared free-of-charge between participating companies. Fostering cooperation is one of the roles played by the clusters or "pôles de compétitivité" which exist in Europe in the semiconductor and equipment and materials supplying industry sectors: three of them have the critical mass to play a role at global level, but need to be further supported, notably by the public authorities:

1. In **Dresden**, the Silicon Saxony cluster<sup>19</sup> gathers more than 200 companies employing 25,000 people—developing their activities around three major semiconductor manufacturers, AMD, Infineon Technologies and Qimonda. Between 2002 and 2007, 1.5 billion Euros were invested by the public authorities and 11 billion by the private sector. The cluster is supported by the presence of large research centres such as the Advanced Mask Technology Center (AMTC), the Fraunhofer Center Nanoelectronic Technology (FhG CNT) or the Nanoelectronic Materials Laboratory (NAMLAB). These were founded and are funded both by companies and public research organisations. The Dresden University of Technology, the Chemnitz University of Technology and the Freiberg University of Mining and Technology provide research capabilities and part of the workforce required for the development of the industry.
2. In **Grenoble**, the "pôle de compétitivité" Minalogic gathers 80 companies in the semiconductor and IT area, and 13 universities and research centres. Its activities comprise two clusters, on micro/nanoelectronics and on embedded "systems on chips". It is building up on the presence of the semiconductor manufacturer STMicroelectronics with several production sites, the semiconductor materials company SOITEC, the research centre LETI and the "pôle d'innovation" Minattec, gathering on the same location engineers, schools, research laboratories and a platform to develop the results of research (notably for start ups).
3. In the **Nijmegen Eindhoven** area, the Dutch government created the "pôle de compétitivité" Point One in 2006, with the goals of increasing the turnover of companies active in the nanoelectronics and embedded systems by 30% in 2011, of creating 20,000 jobs by 2011 (of which 8,000 are highly qualified), and of promoting the launch of 8 start ups every year. It is based on the presence of semiconductor equipment companies such as ASML or ASMI and the semiconductor manufacturer NXP, as well as research centres such as the Holst Institute created with the Belgian world leading microelectronics research centres IMEC (located in Leuven) and the Dutch research organization TNO.

The development of these three clusters, which play a fundamental role in the development of the industry in Europe, has to be promoted. The semiconductor manufacturers and equipment and materials suppliers should work together and with the public authorities to take the best out of them, promote their development and the cooperation between them, especially with regards to the development of SMEs and start-ups, who can best benefit from such nurturing environments.

### Establish a More Favourable US/EU Exchange Rate

Since 2002, the dollar has fallen 23.6% in nominal terms and 21.4% in real terms, losing ground against the major currencies such as the yen (8.9% so far in 2008) and the Euro (7.6% so far). This has a direct impact on the European equipment and materials suppliers: an unstable foreign exchange environment produces missed revenue and unclear profit forecasts, as well as a cost containment attitude by their customers. Unable to control the exchange rate environment beyond hedging activities, most semiconductor companies are focusing on cost-reduction activities. In some cases, they are renegotiating supplier contracts and transferring overhead costs and other manufacturing activities to regions that are more immune to the weak dollar<sup>20</sup>.

<sup>20</sup> *EE Times: The New Challenge for Tech Companies: Currency Fluctuations*, May 2nd 2008.

<sup>18</sup> *Proposal 18; FIEEC report "Une Stratégie Industrielle pour les Marchés du Future—La Croissance se Construit Ensemble"*, June 2008.

<sup>19</sup> *Silicon Saxony and Wirtschaftsförderung Sachsen: Microelectronics and Information Technology in Saxony*, May 2008.

## 4 CULTIVATE EDUCATION AND WELCOME TALENT

The semiconductor equipment and materials industry faces growing challenges in sustaining a well-qualified workforce equipped to accompany the rapid evolution of the industry and the major innovations already under way. The workforce shortage jeopardises further growth of the European industry and leaves further opportunities to the international competitors, in particular in Asia where interest for technology careers is very high.

### Education of a High-Skilled Workforce

The development of a qualified workforce starts with raising the basic interest of school pupils in technology—before they make a choice for their future university studies or career. This interest raising has to take place between the ages of 13–15.

In 2001, SEMI created the SEMI Foundation to promote educational programmes and support education and awareness in the field of high technology. To this extent, it has established and runs the High Tech U (HTU), a math- and science-based career exploration programme for school pupils (around 15 years old) and teachers (for whom a specific programme has been developed). Over a few days spent both in a semiconductor fab and at equipment or materials supplier's plant, pupils receive training in basic electronics and semiconductor making, doing simple practical exercises. Since its inception, the HTU has involved about 2,000 school pupils and teachers, reaching out to an estimated total of some 33,000 pupils. It was organised 49 times for pupils and 13 times for teachers<sup>21</sup>. It started in the USA and has been developed in Singapore, Japan, and Europe, adapted to local education systems and languages. However, so far the HTU has been sponsored only by industry—which limits its general development throughout Europe.

In its 2005 Competitiveness report, ESIA mentioned Eurostat figures on the “intensity” of science and technology skills in the high-tech industry: 42.9% of total employment compared to 21.6% in the total manufacturing sector. Moreover, scientists and engineers represent 15.7% of the total workforce, against 5.4% in the overall manufacturing industry: the high tech, and in particular the semiconductor equipment and materials industry needs a larger base of highly-skilled employees than many other industries.

The ambitious objectives presented in the Electra report<sup>22</sup> (50% of students sent through tertiary education, among which 25% into technical, engineering and science education in all member states) should be supported—especially since Europe is increasingly facing a demographic challenge and a lack of interest for engineering, technology and scientific studies, especially electrical, electronic and computer science.

21 *The SEMI Foundation 2007 Annual Report*—SEMI, 2007.

22 Recommendation 13 of the Electra Report, *Twenty Solutions for Growth and Investment to 2020 and Beyond*, 10 June 2008.

Attracting students to the semiconductor and equipment and materials supplying industry sector is a very important activity which must be coupled with lifelong training. Lifelong learning is a vital element of education in such a rapidly evolving industry. Programmes should not only focus on keeping the workforce up-to-date with technology developments, but also on promoting European and worldwide exchanges of professionals, between companies and with the research organisations.

To cope with the issue, measures have to be taken in the following areas:

- **Improve the image of industry and increase information among students, in particular with regards to career opportunities based on statistics and foresight scenarios. Special attention should be given to female students;**
- **Intensify cooperation between industry and the education sector to develop and integrate adequate technical and science curricula in the formal education channels; set up European degrees at each level in semiconductor education; these should include a nanoelectronics content;**
- **Encourage innovative forms of training (engineer apprenticeship, transition points between technical and university education, training of less skilled people).**

### Immigration of a High-Skilled Workforce

The development of ICT skills in the EU should be complemented by a strategic immigration policy targeting highly qualified workers. Currently, the EU is singularly unsuccessful in attracting skilled immigrants when compared to countries like Switzerland, Canada, Australia or the United States. Currently, residence permit requirements impede and sometimes even prevent the semiconductor equipment and materials industry to employ third-country nationals on pan-European projects—resulting in lower levels of service to customers and lost opportunities for the providers. Fundamentally, Europe needs to have the instruments to attract the best talents from all over the world without bureaucratic hurdles: this is critical in the global competitiveness battle.

The industry therefore welcomes the European Commission's proposal for a Council Directive on the conditions of entry and residence of third-country nationals for the purpose of highly qualified employment—the so-called “Blue Card”—as a positive development. The Blue Card work permit system will help the industry to attract the necessary talent and also address problems such as the one outlined above by permitting, after an initial two year period, third-country nationals to work across the 27 member states and not be restricted to work opportunities in the single-member state which initially grants the work permit.

## 5 PROTECT AND ENFORCE INTELLECTUAL PROPERTY

The semiconductor equipment and materials manufacturers invest from 10 to 15% of their revenues in R&D and the intellectual property (IP). This is the lifeblood of these companies. Protection of IP rights is an important area of concern for the industry, despite the high level of sophistication of their products: continued IP violations of various forms undermine the development of the next generation of semiconductor equipment and materials.

### International Protection of IP

According to a white paper issued by SEMI in April 2008<sup>23</sup>, total industry financial losses and damages have been estimated from 1 to 2.5% of the semiconductor equipment and materials industry's worldwide sales.

The outcome of this white paper shows that 88% of the interviewed companies, representing 56.3% of the total annual sales of the entire industry, reported some form of IP violation, including infringement, counterfeiting, and theft of core technologies, core products, spare parts and components, trade secrets and trademarks. 54% of companies characterized these infringements as serious to extremely serious. The companies interviewed identified Taiwan, Mainland China, Korea and North America as regions of greatest concern. Specifically, the paper reveals that IP violations exist in Taiwan for 72%, Mainland China for 71%, Korea for 66%, and North America for 64%, while a low level of concern is present in Japan (33%) and Europe (28%).

The form and nature of IP violations in each region vary and occur for different reasons. In particular, it is important to stress the differences between Asian countries and North America. While there are serious problems linked to the inadequate protection of IP rights in many parts of Asia, North America has been traditionally strong in this area, thanks to legal protection and the high penalties for infringements. As a consequence, companies in the North America region generally refrain from intentional IP violations. Still, North America is considered by more than 60% of companies as a major region of concern for IP violations. For the most part, this is for different reasons than those related to Asia, including:

- Disputes about the validity of some patents, or certain claims;
- Challenges against weak IP;
- Trade secret thefts, often by former employees;
- Unintentional infringements.

In some cases, IP violations may occur simply because the infringing party has not been aware of its existence. However, in many cases, the validity of the patent behind the IP is in dispute. This is especially true if the IP is not broad, fundamental, or strong, companies feel that they could challenge it, and have the resources to do so. This is an area of concern for smaller companies and start-ups that lack sufficient resources to pursue and challenge IP litigations, especially against larger competitors.

Nearly 60% of the companies surveyed have taken legal action against IP violations. However, only 48% of them are satisfied with the outcome. In fact, legal processes are too slow, too expensive and unpredictable, and companies are very concerned about the cost and variability of IP litigation.

Also, more than 50% of the companies reported IP-related issues with their semiconductor-making customers, which was obviously seen as a sensitive issue that suppliers are reluctant to confront or discuss in detail. It is therefore critical to educate semiconductor-making customers on the value of IP to the equipment and materials industry. Most chip makers heavily invest in IP themselves and understand the cost to create IP. They should in turn recognize the impact on their suppliers, and work with them to avoid IP violations.

Strong and effective intellectual property protection is critical for semiconductor equipment and materials companies in all regions and throughout the supply chain. A close cooperation between industry and authorities is essential. For their part, governments must recognize that they will greatly benefit from robust IP policies through the attraction of outside investment and the encouragement of innovation by domestic companies.

### Set Up an EU Patent Scheme

At EU level, the semiconductor equipment and materials industry needs strong and efficient IP laws, harmonised throughout Europe. This would help the development of innovation and reduce costs. In this respect, an EU patent and an EU regulatory framework regarding enforcements of those patents or other rights is highly expected. By strong IP laws, SEMI means high level requirements for the granting of IP rights. By efficient, SEMI means that those rights should be provided in a timely manner and at reasonable costs. Innovation and technology development involve risk: the legal framework should be designed to support successful innovation and to reward those who have initially supported the risk. At the same time, the system has to remain balanced and affordable, especially for SMEs.

<sup>23</sup> *Innovation at Risk—Intellectual Property Challenges and Opportunities*, SEMI white paper, April 2008.

## 6 INVOLVE SEMI EUROPE IN NEW EHS LEGISLATION

The semiconductor equipment and materials industry is committed to ensure continual improvement in environmental, health and safety (EHS) performance of its products and firmly believes that it is necessary to be at the forefront of sustainable development to foster European economic growth. However, SEMI Europe needs to be systematically consulted at the earliest possible stage of new EHS legislation, which will help identify the best EHS solutions for the environment and for industry, while considering global competitiveness and implementation issues.

### EHS Legislation and the Industry

EHS legislation impacts almost every step of the semiconductor manufacturing process. The European industry has to comply with a vast array of EU legislation such as the CE marking directives on mechanical and electrical equipment, the REACH<sup>24</sup> regulation on the management of chemicals, the WEEE<sup>25</sup> and RoHS<sup>26</sup> directives on waste from electrical and electronic products, the legislation on PFOS<sup>27</sup> and many other specific pieces of legislation at EU and member states levels. Overseas, it has to comply also with increasingly stringent EHS legislation, including in China. The semiconductor equipment and materials industry generally supports the EHS legislation as it is necessary and technologically feasible to achieve environmental protection.

The semiconductor equipment and materials industry has long recognized the importance of proactively protecting the global environment and it has demonstrated it by developing its own self-regulatory instruments. In particular, SEMI has created a Global Care Program to establish a framework for equipment and materials companies to improve EHS management policies, practices and systems. SEMI has also developed, in cooperation with semiconductor manufacturers and suppliers, an industry-wide standards programme, notably addressing EHS issues. These standards establish guidelines which are adopted by consensus and implemented on a voluntary basis. An example is the "S23 Guide for Conservation of Energy, Utilities and Materials Used by Semiconductor Manufacturing Equipment."

24 EC Regulation N.1907/2006 on the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), 18 December 2006.

25 EC Directive N. 2002/96 on Waste Electrical and Electronic Equipment (WEEE).

26 EC Directive N. 2002/95 on Restriction of Hazardous Substances (RoHS).

27 EC Directive N. 2006/122 on the restriction on the marketing and use of certain dangerous substances and preparation (perfluorooctane sulfonates).

The semiconductor equipment and materials industry follows and contributes also to the development of the EHS objectives set up by the World Semiconductor Council (WSC), which gathers all regional semiconductor industry associations. As an example, on the occasion of their May 2008 meeting, the members of the WSC announced that they reached a voluntary agreement on expectation levels for normalized reductions of electricity (30%), water (45%) used in manufacturing and waste generated (40%) by 2010 from the baseline of 2001<sup>28</sup>.

To find solutions in each of these areas, the involvement of semiconductor equipment and materials suppliers is fundamental.

Also, the industry wants to continue to be proactive in climate change, which is why SEMI committed itself in energy savings too. SEMI and the WSC have established an energy conservation partnership to achieve further energy-savings in semiconductor manufacturing.

### Address Public Concern on Nanotechnology: Specificities of Nanoelectronics

Nanotechnologies bring great potential for social, economic and environmental benefits, from innovative medical techniques to savings on materials and energy, as well as advances in detection and remediation of pollution. However, many nano-enabled applications can also bring potential risks to the environment and to human health.

It must be stressed, nevertheless, that not all nanotechnology-related activities raise EHS concerns. This is particularly the case for nanoelectronics. Indeed, nanotechnology is not new to the semiconductor and equipment and materials supplying industries—it is the next scaling dimension. Nanoelectronics are manufactured in the same safe environments as microelectronics and the industry can build on its experience in working in such environments, and on its work towards engaging with all stakeholders in relevant research to find appropriate solutions.

The semiconductor equipment and materials industry supports the recommendation by the European Commission for the adoption of a Code of Conduct<sup>29</sup> to govern research in the field of nanosciences. The industry shares the principles and guidelines for actions proposed by the Commission as they will improve the implementation of current regulations and the further development of new legislation.

28 Joint Statement of the 12th Meeting of the World Semiconductor Council (WSC), May 22, 2008, Taipei.

29 Commission Recommendation on a code of conduct for responsible nanoscience and nanotechnologies research; C(2008)424 of 7 February 2008.

## SOURCES

- *The European Semiconductor Industry: 2005 Competitiveness Report*, EECA ESIA, 2005
- *Semiconductor Manufacturing Workshop on FP7 Consultation*, 30 January 2008
- *2007 Strategic Research Agenda*, European Nanoelectronics Initiative Advisory Council- ENIAC, 2007
- *European Commission staff working document accompanying document to the proposal for a council regulation setting up the “ENIAC Joint Undertaking”*—Impact assessment—COM(2007) 356 final, SEC(2007) 852, 22 June 2007
- *Innovation at Risk—Intellectual Property Challenges and Opportunities*, SEMI white paper, April 2008
- *Nanotechnology and the Environment, Health and Safety (EHS)*, SEMI paper, June 2006
- *The SEMI Foundation 2007 Annual Report*, SEMI, 2007
- *CATRENE White Book: A Private-Public Partnership for Growth through Innovation in Europe*, MEDEA Office Association, 2007
- *“EnginEurope:” For a thriving European Mechanical Engineering Industry in the 21st Century*, Report and recommendation of the EnginEurope High-level Discussion Group; European Commission DG Enterprise
- *Semiconductor Equipment and Materials: Funding the Future*, SEMI white paper, October 2005
- *Vision 2020: Nanoelectronics at the Centre of Change*, Report of the High-Level Group, European Commission, June 2004
- *For a Dynamic and Competitive Europe*, VDMA Positions on European Policy, 2006
- *Joint Statement of the 12th Meeting of the World Semiconductor Council (WSC)*, May 22, 2008, Taipei
- *Raising Productivity Growth: Key Messages from the European Competitiveness Report 2007*, Communication from the European Commission COM (2007) 666
- *Working Group 450 mm Economic Findings and Conclusions*, SEMI paper, June 2008
- *Nanosciences and Nanotechnologies: an Action Plan for Europe 2005–2009*, Communication from the European Commission COM (2005) 243, 7 June 2005
- *Code of Conduct for Responsible Nanosciences and Nanotechnologies Research*, European Community Recommendation C (2008)424, 7 February 2008
- *Aho Report: Creating an Innovative Europe*, European Commission, 2006
- *Rapport sur l'Evolution du Secteur de la Micro/Nanoélectronique*, Sénateur Saunier, 2008
- *“E-Skills for the 21st Century: Fostering Competitiveness, Growth and Jobs,”* Communication from the European Commission COM (2007) 496 final, 7 September 2007
- *Une Stratégie Industrielle pour les Marchés du Futur—La Croissance se Construit Ensemble*, FIEEC, June 2008
- *Twenty Solutions for Growth and Investment to 2020 and Beyond*, Electra Report, 10 June 2008
- *A “Small Business Act” for Europe — “Think Small First,”* Communication from the European Commission — COM(2008) 394, 19 June 2008
- *AMD Global Climate Protection Plan 2007*
- *Fostering the Competitiveness of Europe's ICT Industry*, EU ICT Task Force Report, November 2006
- *Microelectronics and Information Technology in Saxony*, Silicon Saxony and Wirtschaftsförderung Sachsen, May 2008

## Links

- SEMI
- ESIA
- CATRENE
- ENIAC
- CENELEC
- World Semiconductor Council (WCS)
- World Semiconductor Trade Statistics (WSTS)
- Semiconductor International Capacity Statistics (SICAS)
- Nanotechnologies on EUROPA website

