

**Technology Strategy Board**

Driving Innovation



# Electronics, Photonics and Electrical Systems

Key Technology Area

2008-2011

**EXECUTIVE SUMMARY**



# Executive summary

The availability of electronics and electrical systems has changed the way that society conducts its everyday life, from computers through to electric motors. This ability to harness the potential of the electron is now being matched by the control of light in the field of photonics, from general lighting itself through to lasers in DVD players and supermarket checkouts. It is a common misconception that these industries have disappeared from the UK, especially from a manufacturing perspective, but this is not the case; they have just evolved.

Whether through power supply, sensors, invisibly embedded systems, lasers or displays, the Key Technology Area (KTA) of Electronics, Photonics and Electrical Systems (EPES) underpins activity in all industrial sectors and throughout the consumer market. Global markets for electricity (\$1.2 trillion), electronic products (\$2.0 trillion) and photonics products (\$0.6 trillion) all continue to expand strongly. \$260 billion of this is accounted for by semiconductors, with 900 million transistors being produced every year for every man, woman, and child on Earth. The UK is well placed to profit from these markets, as it benefits from a strong science base and a long tradition of inventiveness in the uses of electricity and light.

## UK business – at a glance:

- EPES manufacturing employs more than 330,000 people in 14,000 UK businesses, with £42 billion turnover. This is 10% of UK manufacturing industry.
- EPES distribution, wholesaling and retail adds £73 billion and electricity transmission and distribution a further £55 billion.
- The value added by these activities totals 4% of GDP, with telecommunications adding a further 2%, and EPES technology underpins activity throughout the remainder of the economy.
- The UK boasts nearly a third of Europe's silicon design companies – three times as many as either France or Germany.

The Technology Strategy Board recognises the importance of these technologies to the UK economy, and will continue to champion a sector that received over £114 million of investment from the Technology Programme during 2004-8. The economic benefits (the goal of the UK's EPES strategy) can be achieved by developing ideas from the science base into industrially relevant new EPES technologies, and onwards to become products in the marketplace; but they can also be achieved by the adoption of existing technologies into new applications in the healthcare, transport, energy, retail and environmental sectors. This benefits both the technology providers in the device industries and the technology adopters in the end-use markets.

The EPES sector should always be looking for technology with an identifiable route to market. Those areas, where technology push and market pull are both evident, are of particular interest and provide persuasive arguments for Technology Strategy Board intervention.

This is a summary of the Technology Strategy Board's Electronics, Photonics and Electrical Systems Key Technology Strategy. For the full document see [www.innovateuk.org](http://www.innovateuk.org).

This UK strategy has identified five technology pillars for investment, where Technology Strategy Board involvement will have a significant and lasting impact on the UK economy:

- Control systems and power engineering
- Plastic and printed electronics
- Data and image acquisition
- Communications
- Systems design and integration.

## Control systems and power engineering

Management of electrical power consumption across the EPES spectrum brings benefits to the energy sector, to users of electric power and to the environment [1]. Improvements in device efficiency and system design have a part to play, such as low voltage "solid-state" lighting technologies that promise new levels of efficiency and versatility. In addition, sensing and electronic technologies can provide the intelligence to coordinate electricity demand and supply throughout industrial, commercial and domestic environments.

### The Technology Strategy Board will:

- encourage the development of ultra-efficient lighting technologies and the deployment of products based upon them;
- apply expertise from the EPES Key Technology Area to the challenges within the Low Impact Buildings and Low Carbon Vehicles Innovation Platforms and more generally, for example to reduce power consumption in manufacturing environments; and
- promote transfer of energy efficiency technologies between industrial, transport and built environment sectors.

## Plastic and printed electronics

The UK has a world lead in organic semiconductors and the creation of circuits on flexible materials, and this may lead to new generations of display and lighting technologies as well as electronic devices created on demand, so cheaply that they are high volume commodity items. The challenges ahead include the development of scalable manufacturing technologies and construction of a value chain that retains wealth creation opportunities in the UK.

### The Technology Strategy Board will:

- act as a focal point for analysis of the plastic and printed electronics value chain, and for identifying the opportunities for wealth creation in the UK;
- link technology providers in the sector to end users, business leaders and creative designers, to provide a joint understanding to ensure exploitation of market and product opportunities; and
- having identified the barriers to UK wealth creation, stimulate innovation to overcome them.

## Data and image acquisition

The UK boasts a wealth of expertise in sensor, imaging and laser technology. Combined with the UK's considerable design expertise, these enable increased functionality and underpin wealth creation in diverse sectors of the economy. As examples of the future opportunities, the integration of location sensing into transport systems, logistics and mobile devices will lead to new services and operational models, whilst the networking of context-aware devices leads to 'smart environments' that are responsive to user needs and offer services and capabilities that are impossible today.

### The Technology Strategy Board will:

- ensure that the potential of existing sensing and imaging technologies are promoted to potential end users;
- maximise the potential of these underpinning technologies by stimulating cross-sectoral links between application domains and the fusion of complementary sensing elements; and
- encourage the development and exploitation of location-based technology for consumer and business applications, including the challenges set by the Intelligent Transport Systems and Services Innovation Platform.

## Communications

The ever increasing demand for fixed line and wireless bandwidth at a cheaper user cost requires further innovation and integration of hardware and software, as well as the development of regulatory and business models that are supportive of infrastructure investment. The rewards on offer are an information-rich society, with immersive learning and leisure environments, continuous connectivity and informed decision processes, all enabled by developments in photonics and high-frequency electronic power systems.

### The Technology Strategy Board will:

- champion the benefits of high bandwidth Next Generation Access (1Gb/s and beyond), to position the UK as a world leader in the forthcoming communications revolution, and act to ensure that UK technology is available to support its low-cost deployment; and
- encourage development of systems and services based on wireless communications technologies to enable smart environments.

## Systems design and integration

The pull of technology-intensive end-use markets, such as transport and healthcare, needs system-level design for applications that transcend traditional areas of specialism, and requires cooperative development of hardware and software. For example a laser guidance system builds on the enabling photonics and electronics for drive and control to provide a packaged solution that can cope with harsh environments and work at the push of a button. The UK is a centre of such design knowledge, and with Technology Strategy Board investment is well-placed to leverage this and embed new capabilities into a wide range of products.

### The Technology Strategy Board will:

- promote a systems engineering approach to product design;
- inspire electronics and software designers in the UK to lead the embedded systems industry in Europe;
- bring the UK's hardware and software capabilities together to address the challenges in fields such as robotics and automation; and
- promote an integrated approach between electronics, photonics and control systems for the use of lasers in industrial applications.

## Business framework

This UK strategy builds on previous strategies in this area [2] to further a business framework that encourages all players to cooperate to the best advantage of the UK economy. Planning of the knowledge and material supply chain to maximise value, and networking to establish the contacts and collaborations to realise it, are crucial to success of innovative businesses within a global market.

### The Technology Strategy Board will:

- operate Knowledge Transfer Networks covering the EPES strategic priority areas, to further improve engagement of UK businesses with each other, international partners, the academic base and government;
- ensure that the interventions it targets at the EPES sector are accessible to SMEs as well as larger organisations;
- connect the EPES businesses to the UK science base using Knowledge Transfer Partnerships, including short duration KTPs which will support the more immediate requirements of SMEs; and
- identify and signal requirements for metrology, standards and regulation.

Working with branches of government and with major stakeholder groups in industry is essential to the success of this UK strategy. The EPES team works with DIUS (the Technology Strategy Board's sponsor), with the Research Councils to ensure alignment of science and technology development strategies, with BERR on the business and regulatory environment, with the Regional Development Agencies and the Devolved Administrations to coordinate national and regional policy and investment, with UKTI to encourage inward investment and to attract and protect value in the UK, and with other government departments to investigate technology synergies and sector overlaps. Technology Strategy Board will also work within Europe to represent UK interests, influencing the EU research agenda of the ICT and NMP portions of Framework Programme 7 and ensuring that EU funding complements national programmes. The industry sector also provides its own voices in the form of the Electronics Leadership Council and the Photonics Leadership Group. The EPES team will work with these, linking up the technology and innovation agenda with those of industry leaders, Trade Associations, Skills Councils and others.

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