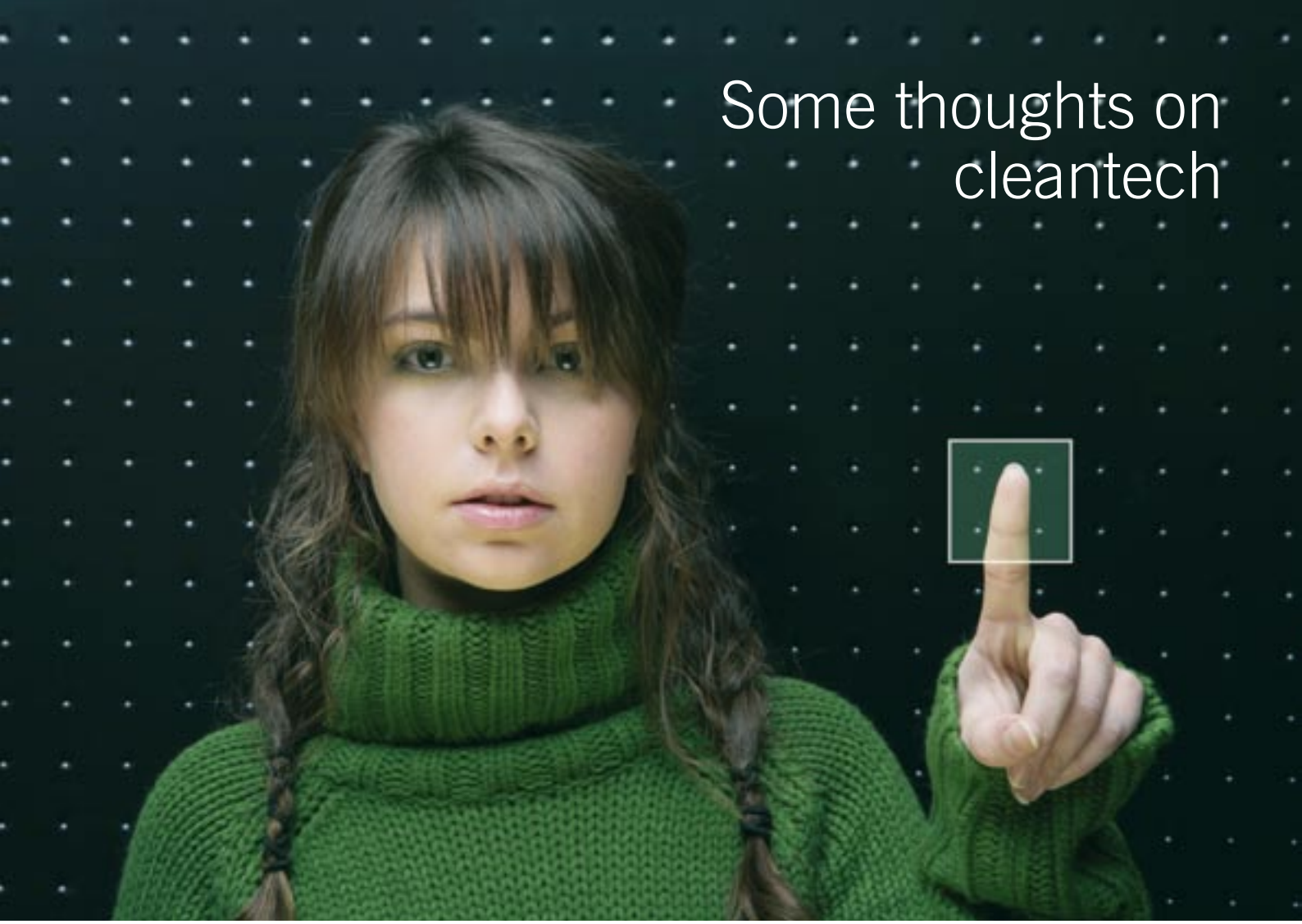

Some thoughts on cleantech

Data stored in a *Flash*

Until relatively recently, electronic system designers could only choose between Read Only Memory (ROM), the contents of which are unalterably defined in manufacturing, and Random Access Memory (RAM), which can be written to and read from at any time but which is volatile and thus loses its contents when power is removed. With the emergence of Flash memory in the 1990s came a third option that offered many of the best characteristics of both ROM and RAM. It is only in recent years, however, that Flash has begun to come into its own and show its true potential.

Flash is non-volatile, meaning it can store data and programs without requiring a back-up battery and obviating the need for back-up storage onto a magnetic disk drive. This has enabled a new generation of portable devices with mass data storage such as portable music players, digital cameras and data memory sticks. And, as the chip industry advances, the size of Flash chips has grown so that GigaBytes of memory can be contained in small, low cost, low energy devices. Consumers see the benefits of Flash today in products like the iPod, and soon there will be laptops using Flash so that they can retain programs and data in memory and therefore restart immediately without a lengthy reboot. Flash memory is also having a significant impact on the devices for industrial, scientific, medical and other applications that we see all around us in today's world of ubiquitous or pervasive computing. For example, it is ideal for devices in the

In recent years, unnoticed by many, a new word has been slowly entering our day-to-day vocabulary, collecting meaning along the way. Cleantech: the new industrial revolution, the weapon in the fight against global warming, the source of future energy security, the new business opportunity.

As usual, there have been cynics, and much of their early scepticism was due to a suspicion that cleantech was just another fad; another way for businesses to exploit all that is green and good about the new environmentally-friendly consciousness. However, as time has gone by, it has become apparent to all but the most hard-nosed that cleantech is here to stay and, more importantly, that it could represent as much of a paradigm shift as the phrase 'high-tech' has come to mean.

Now, the bandwagon being dragged along behind cleantech is very big, and it is relatively easy to hitch a ride, with plenty of limelight and media interest guaranteed. But as an engineering-focused research and development company, Cambridge Consultants is not in the business of riding on bandwagons. Our interest is in making cleantech happen, and what we're finding is that the best of cleantech is actually the same as the best of engineering. It's all about optimisation and efficiency.

So how is cleantech playing out in the world of product development? Well, much of the dialogue around carbon emissions and sustainability places the burden of responsibility for change on the shoulders of the energy industry. "Develop new and renewable energy sources", we cry. "Finance and build a new infrastructure". But is it reasonable and fair for politicians and society to demand rapid change and innovation from an industry where the risks associated with developing new and radical technologies do not sit well with the scale and cost of projects?

Should we not also be looking harder in other areas? We need only ask ourselves whether our current products and systems are using the smartest, most energy efficient technologies. When considered from a cleantech perspective, the answer is more often than not, "no".

Does this mean that we will need to radically rethink the way we design products? In many cases, yes. Brand new categories of product will emerge but for many, the answer will come from a modification in our approach to design. Analytical modelling and simulation will become more important in the optimisation of designs for energy savings. Functional performance will be re-evaluated against user needs. Even with today's technologies, significant changes can be made by simply making different design choices.

Traditionally cost is the overriding consideration when making technical choices, but today the European Energy-using Products Directive mandates the use of EcoDesign measures. Moreover, the rapid rise in energy costs means that market forces and the economics of manufacture are changing in ways that were not fully anticipated even a few years ago. We can only speculate as to where we will be in a few years time. However, one thing is certain. The market will demand ever greater reductions in the energy consumption of our products and services if we are to ensure a sustainable future.

Craig.Webster@CambridgeConsultants.com

home and office that monitor and control energy use and which require complex processing and communications, but which must run from a small battery with a life of many years.

One of the important characteristics of Flash is that its contents can be altered by erasing blocks of memory and then re-writing them with new programmes or data. This is where the name Flash came from when one of its inventors compared the instant of erasure to the flash of a camera. This capability means that devices can be conveniently reprogrammed in the factory or in the field when software has to be changed, perhaps to add new features or to fix a bug.

Many products developed by Cambridge Consultants incorporate Flash memory. It can be in the form of a separate semiconductor device or it can be embedded on-chip as part of an ASIC design. A third alternative for ASIC projects is to combine the ASIC and Flash together as two separate chips in a 'System in Package', or SiP. However, the choice of memory technology also affects the requirements for the processor core and overall system architecture of an ASIC if an optimum design for low cost and low energy is to be achieved.

Chris.Turner@CambridgeConsultants.com

The XAP processor cores from Cambridge Consultants were designed with Flash in mind. They are able to execute programs directly from a Flash memory without the need to first copy part or all of a program to another RAM. They also support an in-field Flash update system that ensures errors cannot be introduced during the procedure. XAP's performance is optimised specifically for Flash that is large and has a low cost per bit, but which suffers a slower access time than ROM or RAM.