The eco-engineering tradition

For more than a decade, NXP has been finding ways to make the world greener. Launched in 1998, GreenChip™ technology improved CRT monitor standby power to less than 3W without the need for a separate standby power supply. Since then, GreenChip™ innovations for all types of power supplies have kept coming year after year to now.

Fast forward to 2010 – and to the automotive sector – when NXP and IBM conducted a groundbreaking road-pricing trial using GPS, telematics and sophisticated routing algorithms to demonstrate that Intelligent Transportation Systems can deliver a 58% reduction in delays caused by traffic jams and a 15% reduction in kilometers driven per year.

In-between: Gigawatt-hours of power saved over two decades by millions of chips serving dozens of applications to billions of people.

Building blocks

The company's ability to conceive, design and manufacture semiconductors that enable environmentally advanced systems and subsystems is not the result of a single competency. NXP's eco-engineering competency rests on four pillars: high-performance mixed-signal fabrication technology, packaging technology, mixed-signal design expertise, and system-level application knowledge gained over decades of serving multiple industries.

Process Technologies: The great divide between semiconductor companies – most designing in the digital domain and a few in the analog domain – is giving way to the reality that we live in a mixed-signal world. High Performance Mixed Signal combines analog and digital technologies to give design engineers the versatility they need to create products that will serve the next decade.

It begins with the fabrication processes themselves. NXP's EZ HV process technology, for example, allows extremely small analog devices operated at high voltages – up to 700V – to be placed next to conventional low voltage digital devices, which creates a very cost-efficient solution. EZ HV drives product innovation in CFLs, High Intensity Discharge Lamps (HIDs), and the power convertor LED products within NXP. Its high voltage characteristics are also useful for photovoltaic applications used in solar panels.

NXP's ABCD9 process sets an industry benchmark for robust high voltage and power processes, fully automotive qualified. It fits a wide range of applications including SMPS AC-DC controllers and power management ICs in automotive, consumer, and computing applications.

Packaging technology: Instead of completely outsourcing its packaging and assembly operations, NXP has historically developed and maintained its own mixed-signal packaging development and operations, which allows it to integrate functionality into a SiP (System in Package). In the end, it's the performance of the IC in its package that matters. NXPs in-house expertise in advanced packaging ensures state-of-art performance in terms of robustness, form factor, ESD protection, and temperature control, to mention just a few key characteristics.

Mixed-signal design expertise: It's all a matter of perspective. Semiconductor companies operating solely in either the analog or digital domains typically approach a mixed-signal system as an exercise in partitioning. Blocks of functionality such as amplifier, power management, memory, data acquisition blocks etc. are arranged so that analog and digital are separated, perhaps even becoming separate chips.

But even before the first single-chip TV tuner was developed at NXP in 1999, there had arisen a tradition of approaching mixed signal as an exercise in function transfer. The design culture of about 3200 design engineers of which over 2600 are in High Performance Mixed Signal businesses – is at least a little different than their counterparts at most ICs companies. Their mixed-signal mentality often enables smaller, faster, more energy efficient chips.

Applications knowledge: Its history as a multimarket supplier of ICs has invested NXP with a deep reservoir of institutional knowledge across many applications areas. Designing the mixed-signal chips of the future depends on a nuanced understanding of what the system-level product really requires. This application knowledge is the fourth pillar of NXP's eco-engineering competency.

NXP is well positioned to continue to contribute to greener vehicles, lighting, solar power generation, power supplies, and smart power/smart grid applications using its innovative semiconductor processes, design expertise and investments in applied research.

Conclusion

When the semiconductor industry began more than half a century ago, the ideas of greening the environment and eco-engineering were hardly on the founders' minds. But just four years after the integrated circuit was invented in 1958, Rachel Carson's *Silent Spring* (the book widely credited with setting off the modern environmental movement) was published. At the time, few would have guessed that a couple of decades later society would be severely challenged to reduce overall energy consumption, and at the same time realize a major shift from fossil and nuclear to sustainable energy sources.

The focus has shifted from reducing the emission of hazardous and toxic materials in air, water and soil to limiting carbon emissions and keeping power consumption in check. Electronics and semiconductors in particular have a vital role to play at this stage because semiconductors can play a pivotal role in managing and reducing the vast amount of energy that is essentially wasted by electronics today.

This Green Paper has attempted to summarize NXP's leadership in reducing power consumption and its commitment to eco-engineering, which is realized through its cross-domain knowledge in applications and High Performance Mixed Signal technologies. These competencies are being extended across the application areas explored in the Green Paper where they will enable the design of further more chips that keep the world greener.