



Technology expert Dr Geoff Archenhold reviews the technological innovations of 2015 – a year of industry restructure and where LED overtook traditional volume manufacturing.

2015 TURNS UP THE VOLUME

Last year saw the beginning of the lighting industry restructure with announcements from Samsung and Philips. This year was more of the same with OSRAM announcing it will spin-off its US\$2.5bn general lighting business, including LED lamps and GE moving its lighting business into Current - a new energy focussed business.

One could be forgiven to think that 2015 has been quite uneventful with yet more of the me-too LED lighting fixtures launched by a raft of well-known, start-up and huge but unheard of Asian lighting players. However, there has been seismic shifts within the lighting industry that will have ramifications for the lighting industry over the next few years and beyond.

Several of the key points from 2015 include:

- The loss of one of the great LED pioneers;
- The expansion of the general lighting industry restructure;
- The rise of the Chinese superpower lighting industry;
- The last remaining lighting applications fall to LED technology;
- LED lighting becomes the most popular light source by volume.

DR. ROLAND HAITZ

One of the few pioneers of the solid-state lighting revolution and an engine of innovation that inspired a generation of scientists and engineers to create the LED industry, Dr. Roland Haitz sadly passed away at the age of 80. Dr Haitz's career in science, opto-electronics and solid-state lighting spanned more than 50 years, most of it while associated with Hewlett-Packard and its offspring companies, Agilent, Avago, and Lumileds.

Although a large proportion of people in the general lighting industry may not know of Dr Haitz, those of us who have been in LED lighting for many years regard him as the catalyst for changing the lighting industry forever through both scientific excellence and political persuasion. His predictions



Dr Roland Haitz, who died earlier this year.

through Haitz's Law - the metric he formulated - and his personal efforts in securing national funding in the US for developing a then-nascent LED technology, helped to usher in the solid-state lighting revolution in less than a decade.

Haitz's Law was a fundamental stepping stone for the industry and I have constantly referred to it since my very first article for *mondo*arc* in 2005, initially as a way of persuading a very sceptical lighting industry that LEDs were its future as well as persuading the UK government it should devote resources to this technology.

Haitz's Law is the equivalent for LEDs and lighting what Moore's Law is for transistors and microprocessors, stating that every decade, the amount of light output by an LED (measured in lumens) increases by a factor of 20, while the price per lumen falls by a factor of ten. In formulating this, Dr. Haitz was the first to grasp the potential for massively reduced energy consumption and correctly predicted the time-scale and degree to which LEDs would triumph over all other lighting technologies in efficiency and cost. Like Moore's Law, his predictions for LEDs were so accurate that they guided the investment and R&D strategies of the solid-state industry, initiating and sustaining an ongoing transformation in lighting that has progressed from his personal vision to global revolution in the last fifteen years.

His zest for the lighting industry didn't wane at all and at 76 he teamed up with fellow luminaries to join a new start-up, QuarkStar, and filed over ten patents in just the last four years alone.

His last remarks on solid-state lighting underlines the progress yet to come: "Solid-state lighting is where the internet was in the 1980's. Just as we could not then have predicted what the internet is now, 30 years later, we cannot foresee all that light and lighting will become in the next decades. We know simply that it will be wondrous and beautiful."

Dr Haitz was an incredible person, father and grandfather and I truly hope history will remember him as a great pioneer of the lighting industry.

INDUSTRY RESTRUCTURING

The biggest news this year has been the continual restructuring of the leading industry players with key announcements from Philips, Osram and GE, all of which will change the landscape forever. The sale of Lumileds to Go Scale Capital from Asia by Philips was continuing apace until it recently hit competition fears in the US. Although the divestment is inevitable, the total spin-off of Philips lighting from group was a less expected announcement. The latest move by Philips confirms the divestment of Lighting is moving at pace, and 2016 will be a year we will see Philips without lighting for a first time in over 100 years.

In April, Osram followed suit and announced it will be spinning off its general lighting business, including general LED lamp based lighting, into an independent company. This was again a major industry decision as in fiscal 2013/14 this business generated worldwide sales of about €2bn (US \$2.15bn) or approximately 30-40% of Osram's turnover and has over 10,000 employees. Reasons given at the time were Osram (like Philips) were trying to