Going beyond lighting

Global LED manufacturer Osram has started a fresh corporate chapter in its quest to become a technology-driven company connecting smart lights and other digitised objects to the Internet. The company sees growth for its semiconductor-based technologies across a variety of verticals, ranging from automotive to telecom through to Virtual Reality applications. Its services range from lighting-based indoor location services such as Osram's Einstone to embedding outdoor lights with sensors that help take note of things like traffic, parking, air quality, and much more. To accommodate Osram's growth in this space, it has invested heavily in expanding production capacity at various locations, including its new LED chip factory in Kulim, Malaysia. Dr. Stefan Kampmann, Chief Technology Officer at Osram, explains how they're going "beyond lighting".

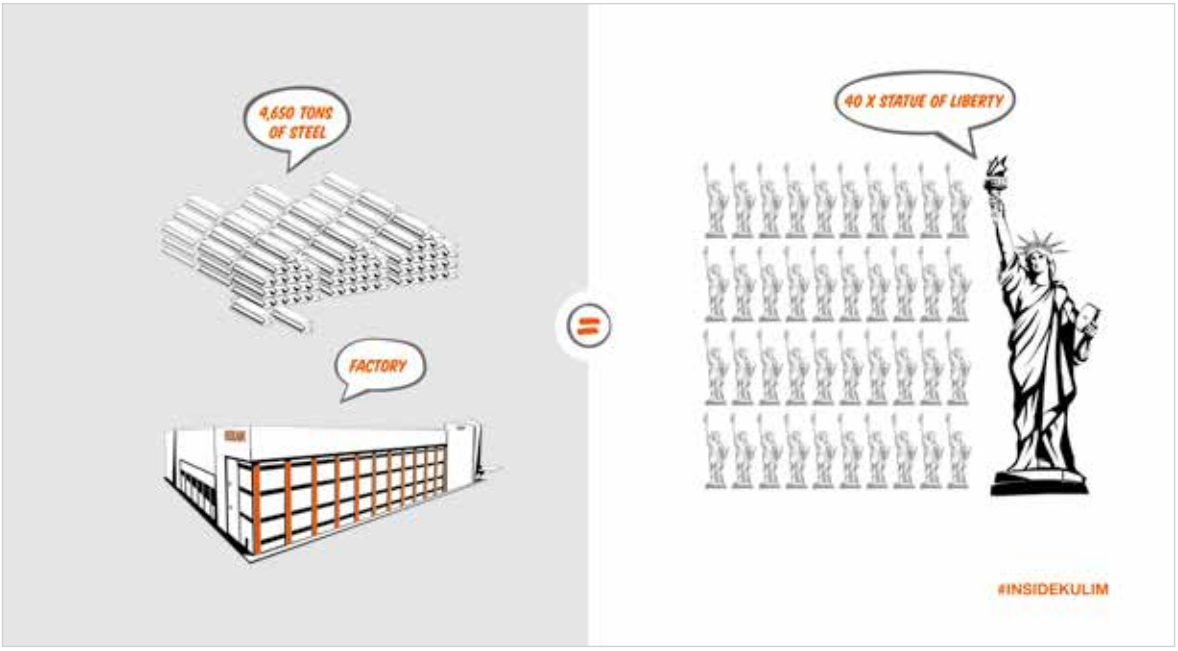
The Osram brand was first registered in 1906. The name refers to the two materials that were needed at the time to produce filaments - initially Osmium and later Wolfram (or tungsten as it is now more commonly known). It quickly evolved into a global player in the lighting industry, boasting leadership through innovations such as the first energy saving light bulb. In recent years, with the traditional light bulb business in decline and the market for light-emitting diodes (LEDs) on the rise, the company has switched focus to semiconductor-based technologies and divested its traditional lamps business. The latter was carved in 2016, into a separate entity which today operates independently as LEDvance.

Dr. Stefan Kampmann joined the company in July 2016, having previously several positions at Bosch and was Member of the Divisional board of the gasoline division. In his view, Osram is proceeding very well on its way to a high-tech company. "Our technologies are now used in applications ranging from virtual reality to autonomous driving as well as from smart phones to intelligent lighting solutions – like the new light solutions for the Vatican."

The high-profile Vatican project involved Osram fitting the Sistine Chapel in Rome, Italy with LED-based fixtures, which consume 90% less energy than the prior installation. This was achieved through the installation of 7000 LEDs from Osram Opto Semiconductors in custom fixtures that were especially designed for the Vatican. Beyond energy savings, the LEDs have given visitors enhanced viewing of the famed frescoes.

The opto-semiconductor business is one of Osram's three 'pillars', Dr. Kampmann explains. "Today, Osram's Specialty Lighting pillar, serving mostly automotive costumers, is the largest pillar by sales. But Opto will be in some years. Globally we have a number two position in this field and we are gaining market share continuously. In total, we reached sales of 4.1 billion Euros in the past fiscal year. And we continue to grow."

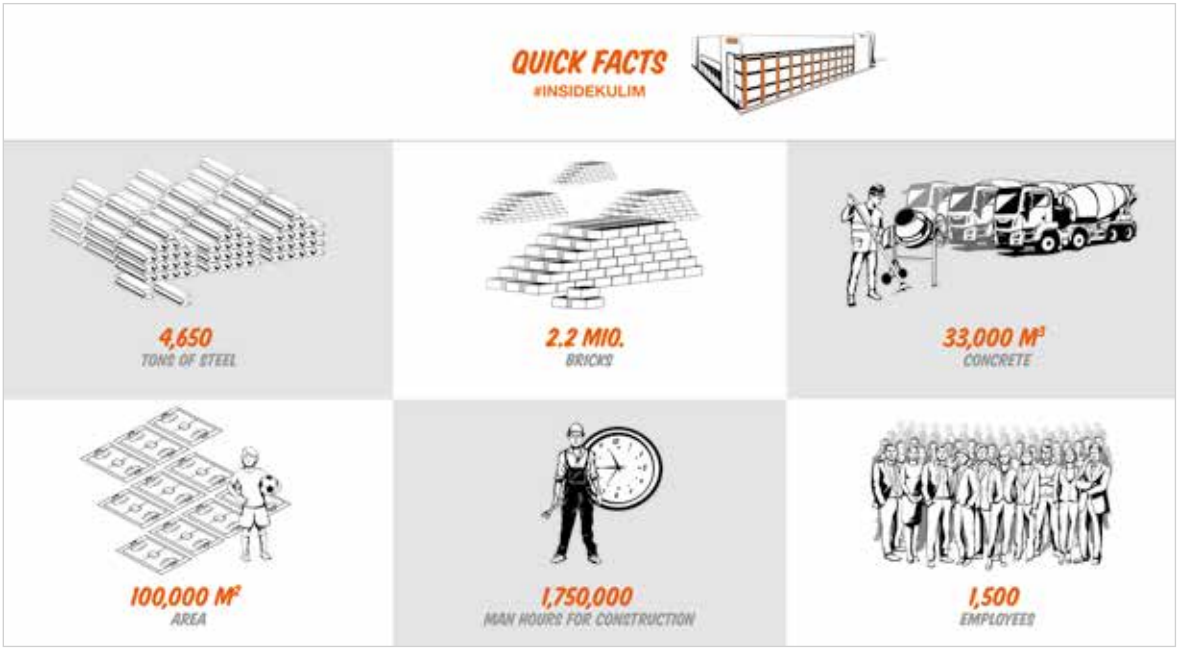
Osram's revenue has grown exceptionally strong in the business with infrared products. These products are used for iris

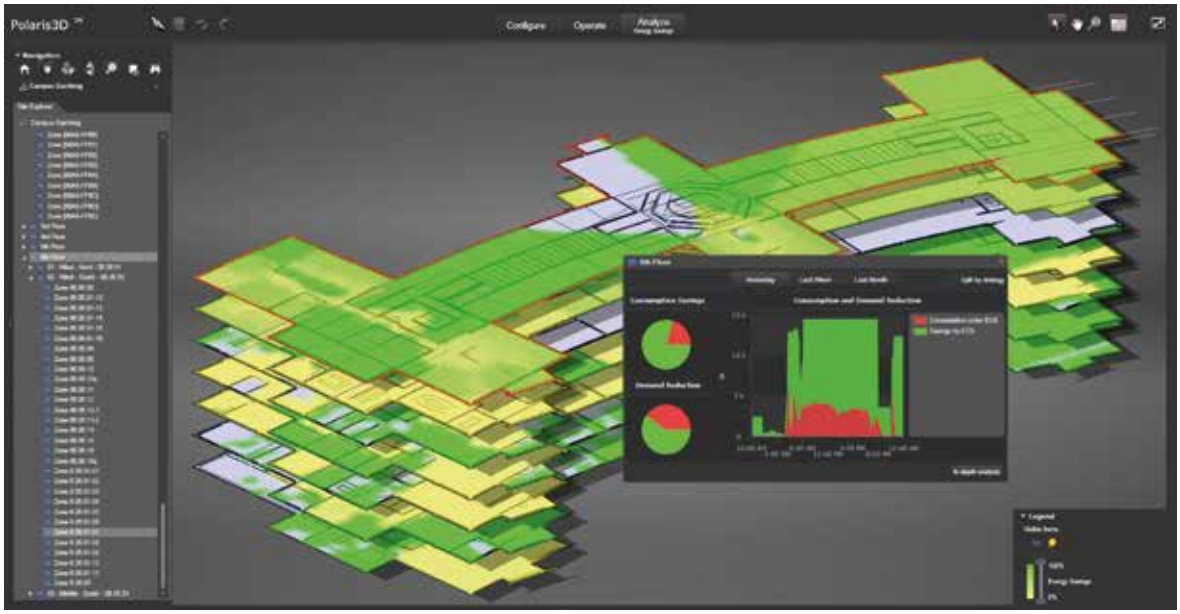


scans or in fitness wristbands and smart watches, among others. In response to strong market demand across various market segments, the expansion of production capacities is on its way. In Regensburg, construction started in March 2017 to increase existing production square footage. Work on expanding the back-end capacity in Wuxi, China, began in August of the same year, and the new LED chip factory in Kulim, Malaysia, has begun operations on schedule.

Osram has a long history in Malaysia; it started to operate a fab in Penang n 1978. The Penang fab, where close to 8000 people work for Osram, supports their new site in Kulim, which is only 30 kilometres away. In November 2015, as part of its Diamond innovation and growth initiative, Osram announced plans to build the new LED chip factory in Kulim and to have it up and running by the end of 2017. The modular, expandable factory has now been put into operation just two years after the announcement and one and a half years after the ground-breaking ceremony. A total of €370 million were invested in the first stage of completion. Osram can expand the factory in two additional stages, entailing total investment costs of up to one billion Euros – including expansion of LED assembly capacities in Osram's global factory alliance.

"Our new factory marks the cornerstone for our approach of profitable growth in a relatively new market," Dr. Kampmann comments. "With the factory in Kulim, the most modern plant in the world which produces on 6 inch wafers, we gain scale in a highly competitive market. Let me show the difference: On a 6 inch wafer, we can produce 160,000 LED chips compared with just 70,000 on a common 4 inch wafer. So, we can satisfy a part of the high and still growing demand for white LED chips worldwide. "





When fully loaded in phase one, Kulim has a capacity of 13,000 wafer starts per week. "With the production of just one week, you could retrofit the street lighting of the four megacities New York, Rio de Janeiro, Hongkong and Berlin," Dr. Kampmann elaborates. "In the first phase, we create 1,500 jobs there. And still have plenty of room there. We could increase our production space by the six fold there, depending on the demand."

The market for LED chips is not only growing; it also is extremely diverse, as illustrated by Osram's most recent product launches which include the compact Oslux S2.1 multi-chip LED, which brings together all the high-tech company's extensive technical know-how into a new LED version for camera flash applications, and Topled E1608, setting new standards in miniaturisation particularly for the automotive sector, for applications such as displays, ambient lighting and backlighting of switches and instruments. In other recent news, Japanese start-up company FOVE offers users a virtual reality headset that integrates eye tracking as a novel means of interaction, using Osram's Tiny ChipLEDs to provide the infrared illumination to track the user's direction of gaze and eye movements. More specifically, FOVE uses SFH 4053 ChipLEDs from Osram Opto Semiconductors, which are only 0.5 mm x 1.0 mm x 0.45 mm in size. Their emission wavelength of 850 nm matches the spectral sensitivity of the camera sensor and their beam angle of +- 70° ensures an even illumination of the eyes.

"Besides visible light, invisible light becomes more and more important," expects Dr. Kampmann. "That means technologies for sensing, treating and visualisation will get a bigger share in our technology portfolio. One important application will be autonomous driving, where our infrared technology will play an important role in systems like LiDAR to navigate autonomous driving cars through the street environment. Horticulture for growing vegetables in vertical farms close to the big cities will become more common for feeding agglomeration. In general, it is about light technology beyond lighting."

OSRAM

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