



In developing economies, top technology and in-depth knowledge of local needs are leading the way in power engineering (large photo), wastewater treatment (p. 57, left) and healthcare (right).

Research without Borders | Innovation in Emerging Markets

Products Set to Sizzle

Working in international networks, Siemens researchers and developers are coming up with inexpensive yet sophisticated entry-level products. These products have what it takes to become market leaders, and not just in emerging economies.

There is a flicker, and yet again the lights go out on Hosur Road. Here at the research site of Siemens Corporate Technology (CT) in Bangalore, the power fluctuations of the electrical grid lead to regular blackouts. When the lights go on again after a few seconds, Dr. Zubin Varghese of Siemens CT explains the causes of the blackouts. "India's population and economic output are growing at a breathtaking pace. More people, more prosperity, more air-conditioning systems. The expansion of the power grids simply cannot keep up with this pace. When there is an overload, the networks simply collapse," he says.

Varghese is responsible for the development of sustainable technologies for emerging markets at CT in India. He and his team are working on solutions that help raise the standard of living over the long term and in affordable ways for a billion Indians — and people in emerging economies around the world. It is often the case that the solutions used in industrialized nations are too expensive and do not adequately meet the needs of emerging markets.

The price of a product is the key factor, according to Varghese. "When a product developer here sees a car, the first thing he thinks about is how he can manage that at one tenth the price," says Varghese. "There are then two ways to go. You can build a vehicle with three wheels and no engine," he says jokingly. "Or you consider very carefully what the customer in our market actually wants and can pay for — and then develop according to these specific requirements. The result could be a Tata Nano, for example." More and more Indians are taking a fancy to the Nano, which is considered the cheapest car in the world. It has become a symbol for extremely inexpensive products — from emerging markets for emerging markets.

High Tech, Low Cost. Siemens does not build automobiles, of course, but it does build many other "smart" products around the world. In this context, "S.M.A.R.T." stands for "Simple," "Maintenance friendly," "Affordable," "Reliable," and "Timely to market." In other words, these are entry-level products that are perfect-

ly tailored to the needs of certain market segments (see *Pictures of the Future*, Spring 2009, pp. 72-105).

For example, Varghese's team has developed a low-cost, energy-saving waste water treatment method. In India, this is quite a big challenge. The country produces roughly 29 billion liters of waste water every day, of which only one quarter is treated. In addition, conventional treatment plants consume lots of energy, because oxygen has to be pumped in continually.

With this in mind, Siemens researchers in Bangalore have built a bioreactor in which certain algae and bacteria enter into a symbiotic relationship. While the bacteria generate CO₂ that the algae need for photosynthesis, the algae emit oxygen, which is in turn required by the bacteria for their growth. It is a perfect cycle — and 60 percent less energy-intensive than conventional methods. This development has kindled the curiosity of Siemens researchers in Germany, as similar processes could be used to fix CO₂ from fossil-fuel power

plants and convert it to biomass in algae, perhaps even on a large scale one day.

"Increasingly, engineers from India, China, Brazil, Europe and the U.S. work together in international teams in which the members contribute what they are best at," says Dr. Uwe Linnert, who heads the Sensor Systems Global Technology Field at CT in Erlangen, Germany. Linnert views the research and development center in Bangalore as an integration and consulting center for the region — a place that, with its deep understanding of the local market, helps turn the results of research and development into innovative products.

Another result of the international cooperation between Varghese's team and Siemens colleagues in Germany is the Fetal Heart Monitor (FHM), a device that can monitor the heart rate of fetuses in the womb. While ultrasound technology is often used for this in advanced nations — where the machines can cost several thousand USD — the Fetal Heart Monitor

uses special microphones instead. The resulting device costs significantly less than ultrasound. The idea was conceived and developed into a product in India. The team led by Linnert, which is based in Germany, helped with the development of the special microphones. "The cutting-edge research takes place where the cutting-edge researchers are located — which is still usually the established industrialized nations," Linnert says. "But product development is increasingly taking place where there are fast-growing markets — in emerging economies, in other words," he adds.

Other examples of successful German-Indian collaborative projects have included work on optical sensors and camera technology for the Indian market. These technologies are now helping Indian cookie factories to greatly increase their quality and efficiency by identifying imperfectly-baked cookies in a fraction of a second (see *Pictures of the Future*, Spring 2009, p. 85).

This success was made possible thanks to excellent cooperation between Siemens engineers in Brazil and their colleagues in Germany, who passed on their know-how. This knowledge transfer has helped the Brazilians to perform more of the engineering themselves, such as complex calculations of rotor dynamics. But that doesn't mean that German engineers are going to have to look for new jobs any time soon. For instance, according to Dr. Detlef Haje, principal engineer at a major steam turbine plant in Görlitz, Germany, "The plant is about products that are engineered to order. In contrast, our colleagues in markets such as Brazil and India specialize in standardized solutions for emerging countries — solutions, in other words, that can be manufactured with simple processes."

A different example, the Trainguard MT train control system, shows that the new markets being opened up with S.M.A.R.T. products are not only in emerging economies. In order



New Markets in Brazil. International innovation processes can be used to tap into new market segments in Brazil too, according to Siemens engineer Thiago Pistore. He coordinated a Brazilian-German development team that made design changes to a steam turbine conceived for the European market and arrived at the SST-300, a turbine ideal for use in Brazilian sugar mills.

"We had to make sure that the whole turbine could be manufactured in Brazil. To do that, we had to learn to make sacrifices here and there," says Pistore. "The resulting turbine is a bit less flexible and slightly less efficient than the model it was based on. But on the other hand, at the time of market entry it was priced at approximately thirty percent less." (see *Pictures of the Future*, Spring 2009, p. 88). The modified turbine is now being sold not only in Brazil, but in other Latin American countries as well.

"A little less flexible, a little less efficient — and 30 percent cheaper."

to increase train throughput and therefore capacity on heavily traveled subway routes, the control centers need information about exactly where trains are located at any particular time. One possibility is to install cables. The inexpensive alternative, however, is wireless technology. In this case, trains report their position via a

wireless signal to receiver stations. "We're using mostly off-the-shelf components," says Matthias Lampe of Siemens CT China. That means parts and wireless LAN equipment that you can buy in a normal electronics shop, such as radio modules or antennas. The actual challenge is to assemble these components into an integrated solution that is not only inexpensive but also reliable and safe. Siemens engineers

and external partners from China, France and Denmark overcame this challenge by working in an international team. In subway tunnels in the Chinese cities of Beijing, Nanjing, Guangzhou, and Chongqing, a Siemens wireless solution helped reduce the interval between subway trains from three minutes to half that time. The system is now being used not only in Chinese cities, but also in Stockholm and Istanbul. Additional orders have come in from Copenhagen and Helsinki.

One Third Cheaper. These examples illustrate that S.M.A.R.T. products are finding their way into industrialized countries. At the same time, however, markets are maturing in emerging economies. As customers in such countries gain experience with entry-level products, they begin to want more sophisticated equipment. A Nano can, for example, make

people desire the luxury features of a premium car. The waterproof cell phones with flashlights that conquered the Indian mass market several years ago are now being replaced in large cities by more stylish devices. One example of a S.M.A.R.T. product that can be successful in both markets is the Multix Select DR digital X-ray machine. Its price is around one third below comparable previous digital X-ray products from Siemens — a high-tech product at low-cost prices, affordable also for smaller hospitals and private practices.

Particularly high demand is expected for this machine in emerging economies, in which only analog machines have been affordable in this market segment until now. China, for example, wants to introduce end-to-end digital processes for imaging procedures in provincial hospitals in order to accelerate diagnoses and make such processes more secure. But the Multix Select DR will almost certainly be used increasingly in Europe and other developed markets as well — for example, as a secondary device, to make more standard examinations possible.

The software for Multix Select DR was developed using platforms established in Germany and Spain. Siemens engineers in Goa concentrated on the mechanics, such as the design of the examination table. Project management and systems integration, in turn, were handled in China.

All in all, there are ten man-years of development time invested in this product. “Development costs, local product management, and local added value play a major role in determining market price,” says Bernd Ohnesorge, who heads the radiography products business unit at Siemens Healthcare.

Siemens’ Multix Select DR is being manufactured in Shanghai, which means that suppliers are charging low Chinese prices. However, in the case of relatively cheap machines, transportation costs make up a larger percentage of the total price. One day, therefore, the Multix Select DR may also be produced in other places where there is large demand, such as in Brazil.

As the world grows closer together and becomes more complex, simple, functional, entry-level solutions and S.M.A.R.T. products will increasingly be used in addition to high-end machines — in emerging markets as well as industrialized countries. Companies that can serve both segments will have the greatest opportunities in this diverse market, which is at once global and local. One approach is that being taken by Siemens. That approach calls for putting the best heads together and setting them to work on innovations as a global team so that, hopefully, bright ideas will eventually replace blackouts. ■ *Andreas Kleinschmidt*



Camera systems immediately recognize imperfect cashew nuts (top). X-ray machines from India (middle) and China (bottom) are high-tech products at low prices.