Electronics Help TI Save Pennies, Planet

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Microchips today are all about efficiency. Problems that engineers used attack with brute processing speed and massive amounts of memory are now solved by reducing bandwidth bottlenecks and allowing software to intelligently plan and prioritize its own data paths. So when Texas Instruments decided to build a new 300-mm chip fabrication plant in October 2003, they chose the same approach to constructing the facility as with the chips it would produce – smarter, not stronger.

The $300 million, 1.1 million sq. ft. plant is finished now, but the lights are off and the robots will sleep until there is enough market demand to turn it on, explained Paul Westbrook, sustainable development manager, at TI's headquarters and site of the new chip facility in Richardson, Texas. There is precedent for the wait to be several months or even years, he said.

However, the plant's existence is already helping to save money, the environment, and local jobs. Microchips may appear harmless but production requires extensive chemicals and ultra-purified water. So TI's design philosophy is clever but simple: it costs less to save energy ahead of and during production than for suppliers to refine extra energy for future use. Consultants for TI at the Rocky Mountain Institute, in Snowmass, Colo., call this concept "negawatts" and also applied the technique to competitors such as Advanced Micro Devices and STMicroelectronics. Exactly how much energy and water they'll preserve will only be known once the plant opens. But compared to a traditional plant, officials expect to save the annual electricity bill for powering 2,000 homes, lighting reductions equal to the space of 26 tennis courts, natural gas to supply 500 homes, and water savings of 35 percent. In addition, they recycled 90 percent of construction waste.

In dollars, TI spent less than 1 percent of the building's expense for so-called green technology, but that caused a 30 percent savings compared to the cost of TI's most recent traditional plant. It also means a $4 million annual savings for utilities compared to traditional plants. The figures could balloon further if such efficient methods get applied to TI's other campuses. The savings also helped keep the facility in Texas, instead of overseas for cheaper labor and taxes.

Electronics technology underpins everything at the plant. Every light fixture has a motion sensor and is connected by Ethernet to a monitoring computer, which adjusts the candle power based on how much light is already present. Employees will wear transponders which turn off the lights completely when rooms are empty. It's office dweller instinct to leave the lights on when you simply walk away for a few minutes, but in this facility even most of the physical light switches are eliminated. Employees who need more or less light than the master computer

dictates can adjust the levels through software on their computers.

Clean rooms' air and water supply are another example. Texas Instruments and the RMI found ways to use fewer filters but still achieve satisfactory levels of oxygen purity. Water used for chip washing, an extremely repetitive but vital process, is heated by solar power. And the water which TI expels as waste is actually more pure – too pure for human consumption due to H2O's corrosive effects – than normal drinking water sold by governments. The water itself is monitored by an elaborate series of in-process tools, software, and valves, much of which was custom-built for Texas Instruments. One machine treats organic carbons in the water with a 185-nm ultraviolet light, a process they developed in the early 1990s but improve each year through electronics, TI chemical engineer John deGenova added.

Electronics technology could be responsible for even more savings in the future, RMI consultant Alexis Karolides said. Chips during the construction process are usually inside some other machine, sealed away from the clean room's elements, and increasingly they're handled by robots instead of gloved human hands. That means the operators really do not have to wear such severe astronaut-like protection suits. Sometimes high-tech companies insist on the suits just to emphasize the seriousness of the process, she explained. That could backfire as the people inside the suits suffer from too little light and real human contact, leading to less productivity and additional technical errors.

Luckily for Texas Instruments, there is an existing system of checks and balances provided by the U.S. Green Building Council. The GBC is a non-profit private organization in Washington. Among other programs, they administer LEED – leadership in energy and environmental design – a specification currently in its 2.2 incarnation. Unlike typical electronics specifications, which leave as little room as possible for interpretation, LEED is a set of open-ended suggestions. Buildings are rated by panels of experts, and companies receive credits toward platinum, gold, silver, and bronze status across a variety of technical categories. TI earned a gold rating for the new fabrication plant's administration office and a silver rating for the microchip production area itself. The process doesn't end; soon there will be a LEED 3.0 version to keep companies like TI in a constant mode of environmental advancement. Updates being considered by the USGBC for LEED 3.0 include a life cycle assessment system, the influence of Earth's changing climate situation, and a new bioregional credit rating system – the latter because different regions may have different enviro-tech needs, a steering committee member explained.

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