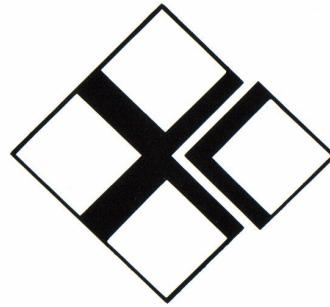


# UPDATE



VOL 5 ISSUE 02

## FROM CAPTAIN KANGAROO TO THE BOARDROOM – WHAT'S THE MOST POPULAR COLOR, KIDS?

**R**emember *Captain Kangaroo*, that popular children's show which aired from 1955 through 1984? Remember the Captain's trusty sidekick Mr. Green Jeans, the outdoorsman and repairman who wore green denim (even on black & white TV)? Mr. Green Jeans and Captain Kangaroo were ahead of their times. . . Looking back we can consider Mr. Green Jeans one of the early environmentalists. I am sure he did not think of himself as such – I don't think many people did in the 1950s. As usual, hindsight is always 20:20 and over fifty years later, green denim and the Captain's Treasure House have been replaced with a new generation of green suits sitting around the boardroom table.

This article will examine the growing phenomenon of environmental awareness as related to the business case for the environment. Corporate leaders today realize that an environmental ethic is essential for the preservation of our planet, but also are learning it makes good business sense, provided it is forward-looking and proactive rather than defensive or reactive (e.g. focused on a remediation mentality rather than one preventing waste in the first place) in nature.

While at a college graduation recently, the President of Vas-

sar College, in her welcoming address, pointed out that students who were wearing a green ribbon pinned to their gowns have taken the following pledge: "I pledge to explore and take into account the social and environmental consequences of any job I consider and will try to improve these aspects of any organizations for which I work." This pledge has several significant implications – it means they will pursue employment with companies who have made a commitment to a greener business model or pursue endeavors that contribute to a cleaner and more ecologically-responsible world. If this is an indication of entry level college graduates' attitudes and perspectives, we should expect a significant impact on the business community.

### Historical perspective

Those of us old enough to remember the first Earth Day in 1970 may recall why millions of U.S. citizens participated in this unprecedented event. Pollutants belching from smokestacks and pouring from outfall pipes were infecting our water and air, and the pollution was largely untreated. In rapid succession, Congress passed the Clean Air Act (1970) and the Clean Water Act (1972) and EPA was created in 1970 to carry out

these important environmental mandates. Wave after wave of federal and state environmental laws and regulations followed (continuing to this day), resulting in over a dozen major pieces of federal environmental legislation and matching state laws and regulations across the U.S.

Rapid, visible and very welcome progress was being made across this country. Fast-forward to the late 1980's and most everyone was happy except one of the most important elements of U.S. society – business. Why? Because environmental legislation continued with increasingly stringent regulations whose target was business. Businesses bore the brunt of the cost of this movement and their response, unfortunately, and with little choice at the time, was inefficient and costly end-of-pipe solutions. Environmental progress but at very high cost begat business's understandable anti-environmental attitudes, some of which persist even today.

Business was, and arguably still is, bearing an unfair share of environmental costs. Meanwhile, environmentalists from the beginning sided with EPA and their "Command and Control" approach with business as the target and main culprit for pollution in the U.S.



## OVERVIEW

We have shifted direction in this article. Not for any lack of interest or change of direction from our last newsletter, but more because of an increasing social conscience and awareness of a movement to take responsibility for our environment. Unlike traditional environmentalists we are approaching the issue as a sound business decision. I am pleased to have my colleague John W. Grosskoph contribute to this article. John has over 30 years of comprehensive experience in environmental program development, implementation and management and is a leading EH&S, quality and security management systems expert.

We believe there must be a business case for companies to become environmentally responsible. (*continued on last pg*)



## New York City's Greenest Office Tower Is Also Widely Hailed as a Bold and Dramatic Addition to Fabled Midtown Skyline

Hearst Tower is the first occupied office building in New York City to achieve the coveted Gold rating under the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) program. The designation recognizes Hearst's commitment to constructing a headquarters to some of the highest standards of environmental quality and occupant health.

Ten years ago, large-scale green building was still a pipe dream. Most of the designs were the architectural versions of horsehair shirts, neither very comfortable nor very pretty. Using less energy inherently meant making do with less—less heating, less cooling, less of the symbolism and grandeur that define great architecture.

Yet by the turn of the millennium green had become glamorous, and today it's even economical. The cycle of innovation for sustainable building technologies is now staggeringly short, given how long it takes to complete a building. In short, we are close to the tipping point at which green design becomes the default option for smart building.

*July 21, 2006 Business Week*

## FROM CAPTAIN KANGAROO TO THE BOARDROOM

### **Context**

This is where we examine business's reactive response to EPA's Command and Control scheme. Businesses polluted, then cleaned up according to EPA mandates, polluted a bit less, more legislation was passed and they cleaned up a little more. Still there was pollution, so additional industry sectors were targeted and they cleaned up. Today we are still cleaning up and have a long way to go. The context was all wrong. The business model was to not seek preventive long term solutions, but rather buy end-of-pipe gadgets to reduce pollution and buy insurance to cover the consequences of the rest. For decades, the relationship between government/environmentalists (or "the good guys") and business ("the bad guys") was adversarial. Businesses understandably felt environmental responsibility and their business motive (profits) did not mix. The environment 'cost' them profits, and EPA and environmentalists were the cause.

The context was all wrong. A handful of business and environmental leaders have learned that good business and a good environment DO go hand in hand. These leaders re-examined their responses and realized that preventive approaches to pollution (not creating pollution in the first place) was the much better business response. Some, like Toyota, 3M, Patagonia, General Dynamics, and others examined the very way they did business and relentlessly and continuously improved their business efficiency and effectiveness through long term preventive approaches. Profits and the environment improved — simultaneously!

Let's look at another parallel phenomenon. I have done a significant amount of work in the area of industrial safety from the human performance and business perspective. To a construction company, safety is considered a necessary evil. The prevailing perspective is that safety takes time, impacts productivity and costs money as a purely overhead function. Let's put this argument in perspective, albeit a simplified characterization because the consequence is quite complex. A person is seriously injured on a construction site. Let's look at productivity — work stops, and it may take days to restart pending investigations and corrective measures. Let's look at cost — all work has stopped, therefore no billable hours are being worked, but the crews are onsite and waiting to get back to work. The company most likely is self-insured to some level. In my experience, the immediate dollar loss begins at several hundred thousands. Even in this simple scenario, costs can skyrocket quickly, while recouping those monies is a long process. At typical margins of 5%, it can take thousands of hours to earn back the simple cash-out losses. So how much productivity can be saved by taking safety shortcuts? None — it is a losing proposition. The reality is that a good, effective and implemented safety program is good for business, shareholders and workers. (I have articles that explain details of this argument and are available on our web site [www.acmacris.com/update](http://www.acmacris.com/update))

The same context holds true for the environmental argument — but there are major differences. The major consequence in the safety scenario is to the individual

who gets hurt, while the consequence in the environmental context is global. The overall perception of a company that doesn't value safety can be negated by coming in as the low bidder. In the environmental context, perception can be a most powerful motivator for any person having anything to do with a particular business or company. The level of environmental awareness and social consciousness is increasing daily. From attracting and hiring the brightest young talent to appealing to consumers, environmental consciousness is becoming a major issue and being a more environmental responsible company or business will convert to better profits, a more competitive posture and longer-term protection of the business entity's future.

Lastly and briefly, back to us — the main culprit behind our worldwide pollution woes of today. Why us? While businesses were enduring the cost of caring for the environment, we continued in our wasteful and polluting ways. We drive larger and larger gas-guzzling vehicles, we individually now are responsible for 5.5 pounds of waste per day (do the math, over 82,000 tons per day!), up a pound per day in just the last five years with little end in sight. So think about that and reflect on what you can do individually to help turn this around.

### **Beyond tree hugging**

What's YOUR image of an environmentalist? Is it a small boat protecting a whale, a "hippie-type" planting a tree, an organic food stand or a product like a solar panel or wind mill? When we talk about environmental responsibility we are saying it is time for the business community

## FROM CAPTAIN KANGAROO TO THE BOARDROOM

to explore, commit to, and implement environmentally responsible business practices and policies – and STICK TO THEM. This is more than platitudes on posters and proclamations – this is changing the business model and organizational culture. Regulation is just that – regulation – we are talking about business sense, return on investment and responsible business leadership. So you say, this is all fine, but let's get real here.

### **Success Story**

#### Overview

Texas Instruments builds a green computer chip fabrication facility. It's a hard problem-- manufacturers push the edges of materials science to get all those tiny features on the chips, so processes are not well-enough understood to easily swap toxic reagents for nontoxic ones--but it is a solvable problem. The lack of progress is mostly due to lack of priority in R&D--consumers don't care about production impacts, they care about speed. Some fabs are working on making their buildings and support systems better, though. In 2004, Texas Instruments worked with Rocky Mountain Institute to design a greener fab in Texas that saved so much money in water, power, and construction costs that it was cheaper than building overseas. That success simply involved better facility design; imagine if we redesigned the whole process.

#### The TI story

The following has been excerpted from an article by Christina Page, a researcher/consultant with Rocky Mountain Institute, about how Texas Instruments (TI) and the Rock Mountain Institute constructed an innovative new million-

square-foot fabrication plant in Texas. The complete article can be found by following this link [http://www.greenerbuildings.com/news\\_detail.cfm?newsID=27712](http://www.greenerbuildings.com/news_detail.cfm?newsID=27712)

Paul Westbrook, Texas Instruments' sustainable design manager, was instrumental in convincing three TI Vice Presidents that "...applying good design could allow a much more efficient system with minimal capital investment."

A year and a half later, on 18 November 2004 in Richardson, Texas, TI broke ground on a state-of-the-art, high-efficiency, million-square-foot chip fab (including 220,000 square feet of clean room), designed in part with ideas generated during a three-day charrette (*charrette is a collaborative planning process that harnesses the talents and energies of all interested parties to create and support a feasible plan that represents transformative community change*) with Rocky Mountain Institute.

#### The challenge

To compete on cost, Texas Instruments was seriously considering building its new facility overseas. But of course the high cost of fabrication is due not just to its specialized tools but also to the scale and complexity of the elaborate equipment that provides abundant chilled water, clean air, scrubbed exhaust, vacuum, and other "utilities." Using those services more frugally can make the fab cost less, work better, build faster, and win in the marketplace. --- In 2003, Chris Lotspeich, who'd led much of RMI's ST work, nicely summarized the challenges of chip fabs: --

- Fabs have extensive heating, ventilating, and air conditioning (HVAC) systems with high-performance filters to maintain clean rooms' temperature and humidity precisely while filtering airborne particles. Fans, pumps, furnaces, and chillers deliver conditioned air and cooling water into the clean room via ducts and pipes. Energy accounts for [only a few]... percent of a chip's cost, yet electricity can be the largest single [non-labor] operating expense for a chipmaker, totaling millions of dollars annually at a single fab. Moreover, energy-saving measures can improve key operating parameters (yield, setup time, flexibility), and in new plants can save capital and construction time -- critical factors in competitiveness.

• Despite great innovation, semiconductor manufacturing fosters a risk-averse corporate culture due to exacting process requirements, safety risks, the high cost of downtime, and brutal competition in a fast-moving market. It's somewhat ironic that cutting-edge technologies are made in buildings designed decades ago, and thus those buildings now offer significant energy-and money-saving potential.

- Finally, a huge modern fab complex can easily go through 2–3 million gallons of water per day, a quarter of it for cooling.

Now came the hard part: TI's engineers and designers were told to cut the building and utilities cost by 30% over the previous project. "The cost challenge could have been a showstopper," Westbrook said, "but turned out to be a benefit. We literally had to go back to the drawing board on many items. It

gave us a chance to analyze old assumptions and challenge some conventional wisdom.

By driving revolutionary change and jettisoning incremental evolutionary design, the 30-percent-lower-capital-cost goal gave Westbrook and his unfunded "Fabscape" sustainability design team their opening to test the most innovative ideas. Starting in 2002, the team met every two weeks and generated a flurry of state-of-the-art concepts.

#### The process

Their growing stack of white papers soon made a compelling case for a freewheeling-but-disciplined design process to distill out something useable. So in December 2003, a team of RMI consultants came to help TI bubble up and boil down hundreds of nifty notions into twelve "Big Honkin' Ideas" -- concepts that could fundamentally change how TI designed and built a fab and how TI worked with its industrial partners.

A wafer fab is full of exquisitely complex tools made by arcaneously specialized suppliers. Energy efficiency is rarely a consideration when specifying tools. Because process and reliability requirements rule, the customer seldom asks for efficiency, and the toolmaker, that doesn't pay the utility bills, simply isn't used to providing it. It's not that they can't; rather, they've never been asked.

The cumulative effect of *all* the power consumed by *all* the fab's tools and equipment led the charrette participants to trace how each watt of energy consumed by each tool ends up as heat that must be removed, making the cooling equipment bigger and power-hungry -- at a total present-valued cost around \$7 per watt! So the biggest win wouldn't be simply making the cooling equipment more efficient, but making it smaller and simpler by buying efficient tools that would give off less heat in the first place. Equipment would be sized by measurement, not guesswork: as RMI designers say (borrowing from GM), "In God we trust; all others bring data."

#### The ROI

Savings quickly started to breed and multiply. Nearly double-efficiency vacuum pumps, cut to idle speed when waiting for wafers, saved 300 tons of chiller capacity and 7% of the plant's total electricity. Vacuum-pump vendors, initially startled by requests for extra efficiency, soon saw the business logic. Optimizing temperature and pressure drops saved a fifth of internally cooled tools' cooling water flow. Smarter exhaust systems saved 100,000 cubic feet per minute (cfm) of exhaust and its replacement (conditioned fresh air) -- each worth a present value of \$62. Internally cooled tools with heat exchangers designed to lose less pressure and temperature cascaded into a 3,000-gallon-per-minute reduction in the size of the central process cooling water system, saving both capital and operating cost.

As post-workshop design progressed, it became increasingly apparent that smarter tools and their smaller, more efficient supporting systems would cascade energy and water savings. Although the facility will have

to be up and running before anyone can know for sure, Westbrook predicts that the new facility will cut energy use by 20% and water use by 35% compared with TI's previous wafer fab. The savings come about half each from better tools and their direct support equipment and from smaller, more frugal utilities and building systems.

#### Human Factors into the equation

"Whole-systems tool design" wasn't the only breakthrough idea that emerged from the workshop. For example, TI decided to test lighter-weight smocks for clean room workers. Particle tests revealed that eliminating facemasks shouldn't harm product quality, and could make workers more comfortable with less chilling.

Some of the design features explored at the workshop were standard components of green design for non-industrial buildings, and offered tremendous financial benefit. Each waterless urinal, for example, will save 40,000 gallons of water a year, plus the capital cost of flush valves and water pipes not installed -- helpful to a water-intensive industry in an arid climate.

The participants' diverse enthusiasms quickly focused on winning a high LEED (Leadership in Energy and Environmental Design) rating -- a systematic way, evolved with RMI's help, to score points for elements of good design. As Westbrook noted, "The competitive nature of people is a strong force and can be harnessed for good. We like to save energy and reduce emissions -- we love it when we score a point for doing so."

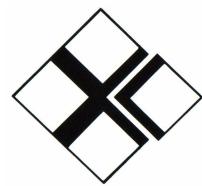
**The Board Room's bottom line**  
The LEED focus seems to be working well for TI. The company will invest \$2–3 million in

LEED-related items -- mostly efficiency gains that would have been incorporated anyway. That investment will return an estimated \$750,000 in operating cost just in the first year, and at full build-out, should save more than \$3 million every year.

In the end, such bottom-line benefits led TI to adopt most of the Fabscape team's dozen Big Honkin' Ideas (though some await further testing and analysis). All the energy and water savings changed the net capital cost by roughly zero -- at most 1% extra, but quite possibly a decrease. Total capital cost per square foot, as required, came in at 30% below normal, blowing away industry norms and keeping the new fab in the United States.

#### **Wrap-up**

Back to Mr. Green Jeans, who would have known back then how important Mr. Green Jeans was. We watched him protecting animals, doing his gardening and helping Captain Kangaroo. Well, his thinking and what he stood for is timelier today than ever. Back to serious stuff, until recently, environmental consciousness was similar to the various "movements" of the sixties, represented additional non-value added costs and was perceived as a barrier to productivity. Today this is all different. The business case for environmental consciousness has been demonstrated. The awareness, as well as the urgency, is higher than ever. One of the fundamental tenets of change management is a Sense of Urgency, and more and more people believe in that sense of urgency. With the business case being established and documented, with the consuming public demanding more environmental responsibility, business leaders are taking heed and realizing it is the time to make a serious commitment to a Green Boardroom.



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**WE SAID THIS ISSUE  
WOULD ADDRESS  
RESILIENCE AND  
ROBUSTNESS—AS  
YOU CAN SEE WE  
CHANGED TOPICS.  
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## **OVERVIEW**

This business case involves more than usual conservation and recycling initiative synonymous with environmentalists. It involves change management, integrated systems and a commitment to exploring new ideas and pursuing concepts.

Consistent with many of our writings it is about Leadership. The consequences of the do nothing option are unacceptable. While regulation is a way of life in the corporate world; at this point good business decisions along with corporate stewardship, changes the boardroom color to green. Three cheers for Mr. Green Jeans!