

FORTUNE

Lobby of the
Bently Reserve Building
in San Francisco

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Igniting Change

Green technology can help save the environment if businesses, governments, and citizens band together to implement change.

Reduce Your Carbon Footprint

Light controls lower energy bills while improving comfort and productivity.

"With the Lutron Quantum® System, we're saving 66% in lighting energy."

— MARK MAYFIELD, CHIEF ENGINEER FOR BENTLYRESERVE.

Igniting Change

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If you want to preview the potential—and the complexity—of a sustainable, low-carbon world, look no further than the electric car. This summer, two automakers unveiled models which, unlike the hybrid vehicles on the road today, can be charged from a standard AC power outlet. Fill up your tank, so to speak, while you sleep, and help cut your dependence on carbon-emitting fossil fuels. The Chevrolet Volt and the Nissan Leaf—both expected to hit showrooms late next year—are technical marvels, to be sure. But to succeed they're going to need help.

Because the cars only go so far on a single charge—100 miles for the Leaf; 40 for the Volt, which has a small gas-powered engine that keeps the car running once the juice is gone—we'll need charging stations where people work and park. Because all the charging will put a drain on the electric grid, we'll need utilities to adjust rates so drivers have an incentive to charge during off-peak times. And because we'll want the car that's been plugged into an outlet all day to charge only when rates are lowest, we'll need software that lets cars and utilities talk to each other.

In short, when it comes to the low-carbon economy our future depends on, having a great product is no longer enough. We've got to have the right infrastructure and regulatory schemes. We've got to encourage and help fund all the startup companies that can bring more value and marketability to the product breakthroughs of their own. One more thing: We've got to do it all very quickly.

More Demand, Limited Resources

The math is sobering. The world's resources—think oil, water, food—are constrained, but the population is booming. By 2050 there will be more than 9 billion people on the planet, according to the U.N. Population Division, up from 6.8 billion today. That means even more demand for already limited resources. The International Energy Agency estimates that without corrective action, energy-related carbon dioxide emissions—now known to contribute to the global warming that's negatively impacting our environment—will rise 45% between 2006 and 2030. "When you look at it all together, you very quickly come to the conclusion that the only way we'll be able to deal with this is by developing resource-efficient, low-carbon systems," says Bjorn Stigson, president of the World Business Council for Sustainable Development (WBCSD), a CEO-led association of more than 200 major companies from 35 countries.

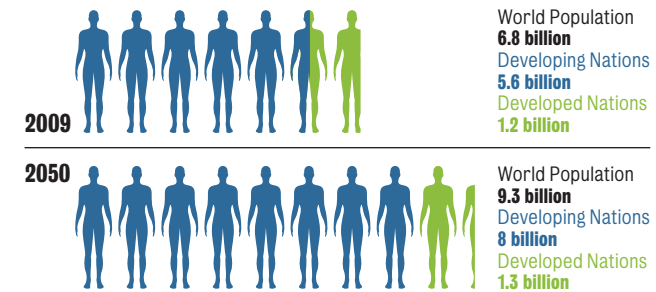
The longer we wait to develop these systems, the worse the problem will get, which means we'll need even more, even harder corrective action. A great deal of the technology we need is already being worked on. But perfecting and deploying it is taking longer than it should, because the frameworks to regulate and help finance these projects are still being hammered out.

In the U.S., Congress is debating climate change legislation,



Population Explosion

By 2050, there will be more than 9 billion people on the planet—up from 6.8 billion today.



Source: U.N. Population Division 2009

and no one quite knows what will come out of the Copenhagen conference in December, when 192 nations will negotiate a follow-up agreement to the Kyoto Protocol, the 1997 global pact to reduce emissions that, in the end, wasn't completely global—or completely successful. The predictability that a framework will provide, says Stigson, is essential: "Companies want to be sure that whatever the government comes up with is not going to hinder them. If the regulatory regime is uncertain, that slows down investment."

Little wonder, then, that the leading companies on the sustainability front aren't just working on the science and the products, but on picking up the pace. They're creating standards for designing carbon-reducing technology and for measuring emissions reductions. They're talking to governments, and providing data and expertise, to make sure that the frameworks that ultimately appear will foster, and not hold back, sustainability investments. They're partnering with one another, and with communities and customers. And perhaps most important of all: They're making the



Photos show spaces inside the Bently Reserve Building in San Francisco which is saving 66% in lighting energy with the Lutron Quantum® Total Light Management System.

business case for deploying the climate-friendly technology we have—and developing the technology we'll need.

The ABCs of Energy

If we are going to tackle climate change successfully, the first thing we need to do is to educate ourselves. That doesn't just mean getting a better grasp of how greenhouse gases impact the environment and our future, but also understanding all the ways we can reduce energy use—an area that, for many of us, is full of surprises. For a long time the discussion about energy efficiency has focused on the cars, fuels, and factories of tomorrow. But there's a lot we can do today, in places we least expect, with technologies already at hand.

Consider, for example, the typical office building. In many ways it's an environmental menace, using energy in a grossly inefficient manner. Lights are often left on when no one is in the room, or kept at maximum level even when daylight streams through the windows. The energy that is wasted adds up. In a four-year, \$15 million study on energy efficiency in buildings, the WBCSD found that, worldwide, they account for an astounding 40% of global energy consumption (and its accompanying carbon footprint), significantly more than all transportation combined. The study—which calls for new building codes and energy-efficient designs, investment subsidies, and other remedial steps—also found that buildings are a place where much improvement can be made easily, at lower costs and higher returns than other sectors.

Lights are a good place to start. In all too many buildings, lighting comes in two varieties: on and off. Back in 1959, a physicist named Joel Spira realized there had to be a better system, where the intensity of light—and the energy required—could be raised and lowered as needed. So Spira invented the world's first solid-state light dimmer. A half-century later, the business he founded, Lutron Electronics Co. Inc., is the world leader in designing and manufacturing light controls. And not just dimmers, but integrated systems—like Lutron's Quantum® total light management system—where sensors detect how much daylight is entering a room and whether a room is occupied, then adjust the light levels accordingly. It's not just about the bulbs, either. Lutron's systems can even calculate the position of the sun and then automatically raise and lower window shades, reducing glare, heat, and, in turn, air conditioner use.

The company estimates that installed Lutron dimmers save users \$1 billion in electricity costs each year. On top of that, the

greenhouse gas emissions saved are the equivalent of taking 900,000 cars off the road. "The key is having smart systems, where all your components work in unison to give you the optimal level of light," says Spira. "The technology is getting better and faster, which means the savings are getting better and coming faster."

That payback—both for the pocketbook and atmosphere—is itself a crucial component. When The Energy Foundation, a partnership of major donors interested in solving the world's energy problems, moved into the historic Bently Reserve Building in San Francisco, it wanted the space—featuring huge, 15-foot windows with plenty of daylight streaming in—to be a showcase for intelligent energy design. The goal: to reduce lighting energy by 45%. "With Quantum®, we're saving 66%," says Mark Mayfield, chief engineer for Bently Reserve.

But making the business case for energy-efficient technology often means looking beyond the utility bills. Products have to be

scalable, so users can add components as they grow. "You have to make it easy for customers to start small and then add to the system," says Michael W. Pessina, Lutron's president of the Office of Product Development. "That's why we've developed sophisticated wireless technology, so you don't have to rip walls and rewire to add more lighting controls. Lutron's new Radio Powr Savr™ wireless occupancy sensor takes only 15 minutes to install and pays for itself in two and a half years."

Flexibility is crucial too. At Georgian College in Ontario, Canada, a professor sets optimal lighting for a whiteboard presentation, a lecture, or a video with just a press of a button. That means productivity and comfort get a boost—and the system saves

Georgian \$137,000 a year on its lighting energy costs. "We really took the time to select the best technology for our campus. We chose a Lutron system because it was the most versatile and simplest to use," says Jeff Choma, manager of Mechanical and Electrical Systems at Georgian College.

More Work Needed

Of course, a truly low-carbon world is going to require more than the technology that's available today. Renewable but often expensive energy like wind and solar need to be deployed on a greater scale than they are now. And because renewables won't completely replace fossil fuels anytime soon, we need to encourage the development of not-yet-mature technologies like carbon capture and storage that can lessen, or even eliminate, the impact of the CO₂ released by fossil fuels.

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— JEFF CHOMA, MANAGER OF MECHANICAL AND ELECTRICAL SYSTEMS AT GEORGIAN COLLEGE.



Georgian College in Ontario, Canada saves \$137,000 on energy costs each year using a Lutron system.

To Reduce Your Carbon Footprint —Dim the Lights

Lutron light controls lower energy bills while improving comfort and productivity.

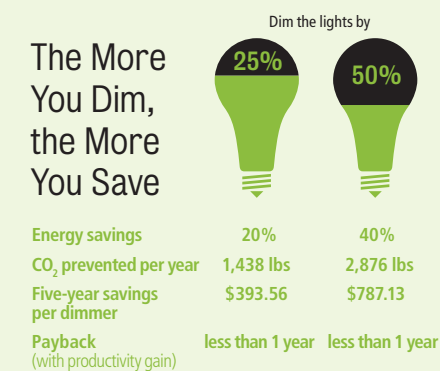
When it comes to reducing your carbon footprint, little things can mean a lot. Take dimmers, which save electricity by cutting the amount of power that flows to lighting fixtures. The lower the light level, the less power is used, and a very small cut in power can translate into very big results.

"We estimate that installed Lutron dimmers save over 9 billion kilowatt hours of energy per year, and that prevents 17 billion pounds of CO₂ from entering the atmosphere," says Michael W. Pessina, president of the Office of Product Development at Lutron Electronics, a light control manufacturer. "That's a savings of over \$1 billion in energy costs each year."

"The amazing thing is that this number is just the tip of the iceberg," adds Pessina. "In the commercial sector, dimmers and other controls can reduce lighting electricity use dramatically."

According to the U.S. Department of Energy, lighting is by far the largest user of electricity in commercial buildings. It consumes 38% of the total—more than space

The More You Dim, the More You Save



Figures are based on using a dimmer on nine fluorescent fixtures with three 32-watt lamps, running 12 hours per day, at an energy cost of \$0.104 per kWh. Savings calculations are compared with energy use of lights that are switched on. Payback based on lighting energy savings, product costs, and a 1% productivity increase.

heating, cooling, ventilation, equipment, and computers *combined*. Lutron light controls can radically reduce that appetite through scalable solutions. Here's how.

Dimmers alone can easily reduce lighting electricity use by 20%. Add Lutron's new Radio Powr Savr™ wireless occupancy

sensor and you can cut lighting electricity use up to an additional 35%. Larger-scale total light management systems combine dimming, occupancy sensing, and daylight control to produce even more dramatic savings: Lutron systems in The New York Times Building (New York), Bently Reserve (San Francisco), and Georgian College (Ontario, Canada) are each saving more than 65% in lighting electricity use annually.

Dimmed lights also keep the air cooler. Many buildings require cooling year-round, so the energy savings can be significant. As a rule of thumb, cooling usage is reduced by one watt for each three watts of lighting that are cut. In addition, Lutron's electronically controlled window shades automatically raise and lower to maximize efficient use of daylight while minimizing heat gain and glare.

Light control also enhances the visual environment while conserving energy. Commercial spaces are usually over-illuminated, and the ability to dim lights to the appropriate level for the job at hand can improve productivity and reduce eyestrain and computer glare. In fact, research by the Light Right Consortium found that employees are 6% more comfortable when they have individual control over their lighting environment. Another study by lighting expert Peter Boyce showed that "people with dimming control reported higher ratings of lighting quality, overall environmental satisfaction, and self-rated productivity."

"The productivity link is huge," says Pessina. "Human resources cost \$318 per square foot, which is more than six times higher than any other operating cost. If better light control can help people work more effectively for five minutes—which is equal to 1% of the work day—the investment in light controls will pay for itself in less than a year." •



To find out how much you can save, visit: lutron.com/green.





Photos of Georgian College in Ontario, Canada, which reduced its lighting bill by 70% with Lutron's Quantum® Total Lighting Management System.



This year saw some encouraging steps. The \$787 billion stimulus package signed by President Obama in February provides \$11 billion for smart-grid investments, \$3.4 billion for carbon-capture and storage demonstration projects; \$2 billion for work on electric car batteries; and an extension of tax credits for wind energy.

But for many technologies, money is just one obstacle. Design standards, or best practices, need to be developed before wide-scale deployment can occur. It's no surprise, then, that creating these sustainability standards is important.

That's where Norway-based Det Norske Veritas (DNV), a global provider of services for assessing and managing risk, comes in. Tapped by the European Commission to help speed industry implementation of carbon capture, it is developing best practices for making the technology work efficiently. "With carbon capture and storage, there are three phases you have to look at," says Henrik Madsen, president and CEO of DNV. "How do you capture

the carbon? How do you transport it to the geological structures where it will be stored? How do you make sure that the storage is safe and long term?"

Working with 10 industry partners, DNV is developing standards for transporting CO₂ in pipelines (something not addressed by current regulations), as well as a methodology for selecting and qualifying proper sites for storage. "By qualifying technology and creating the standards, we help develop the solutions needed for climate change, then get them disseminated and implemented," says Madsen, adding: "Safely, reliably, feasibly."

Developing best practices for sustainable technologies isn't a new line of work at DNV. Nearly 80% of offshore wind farms have been built to DNV standards. Today, a quarter of a century after it first became involved with wind energy, the company is the largest independent certifier of wind farms. DNV also works with energy companies to evaluate potential sites for wind turbines, to measure wind profiles, and to calculate how much energy is available.

Yet when it comes to tackling climate change, technology isn't the only area where standards play a key role. To encourage developed nations to invest in emissions-reducing projects in developing nations, the Kyoto Protocol established a system known as Clean Development Mechanism (CDM). The developed

country would receive credits for the resulting emissions reduction, and those credits could then be used as offsets against their own reduction commitment under Kyoto. The challenge, however, was making sure that CDM initiatives truly delivered results. Mechanisms for measuring reductions and validating projects had to be created. In 2004, DNV was accredited by the United Nations Framework Convention on Climate Change to perform independent verifications of emissions reductions. It has since certified more than 1,000 projects, mostly in China and India.

Poor Grades

When it expires in 2012, Kyoto will leave a mixed legacy. It spawned important mechanisms like CDM and the EU Emissions Trading Scheme, a cap-and-trade system designed to foster emissions reductions by putting a price on carbon (emissions over the cap would have to be offset by credits purchased in the market). But many countries missed their reduction targets, and in the U.S. the Senate never ratified the treaty. "Kyoto would get a 'just-passed' on a report card," says Paul Gilding, the former executive director of Greenpeace International, who now advises companies and governments on sustainability. "It mobilized Europe in particular, but it didn't achieve very much because the U.S. didn't join."

No one expects a comprehensive framework to emerge from Copenhagen, but everyone is looking for a start. "We'll hopefully see an agreement on a reduction target for 2050," says Matthew Bateson, managing director for energy and climate at the WBCSD. "But it's easy to commit to something that's beyond your lifetime.

What we also need are interim targets, say in 2020, which force more immediate actions. We also need to figure out how technology gets transferred, and how everything gets financed. The hope is that in the next two years, we'll be able to fill in these details."

Eyes aren't just on Copenhagen either. In June the U.S. House of Representatives passed an energy bill establishing a cap-and-trade system that requires a 17% emissions reduction from 2005 levels by 2020. But the bill still needs to work through the Senate and plenty of debate—and revisions—are expected.

Walking the Walk

With the framework for a low-carbon economy still unsettled, it's little wonder that industry is making its voice heard, trying to

steer the discussion—and the policies ultimately enacted—in a direction that makes technical, and financial, sense. Consider the energy powerhouse Royal Dutch Shell. Like many of its competitors, it is making big investments in renewable technologies—\$1.7 billion over the last five years. It is also working to reduce emissions at its own facilities, with 2008 levels down 30% from 1990. But Shell has been doing something else, too: It's been talking the talk and walking the walk.

To help governments create the right policies and incentives for carbon capture and storage, Shell has been working with regulatory agencies, sharing data and lessons gleaned from its work in enhanced oil recovery, a process that requires CO₂ or some other fluid to be pumped into geological formations,

just like carbon-capture and storage solutions. "We've got years of experience doing this. We understand the geology," says Libby Cheney, vice president of safety, environment, and sustainable development for Shell Upstream Americas. "We want to make sure that as governments develop frameworks for carbon capture, they're hearing from scientists who work in the area, and gaining the benefits of what we've learned." Since cap-and-trade would put a price on carbon, and thus encourage the development of technologies like carbon capture, Shell has been an advocate for it, as well.

But Shell is talking to communities too, because at the end of the day that's really what sustainability is about: improving the social, economic, and physical lives of those a company impacts. It's a lesson that is often forgotten in the focus on emissions. "You can't just go into a new

area and assume you know how things are done," says Cheney. "You have to take the time to become part of that community, to internalize their values." That can result in decisions that may initially seem costly. Last year, for example, Shell was the only major oil company that did not derive any biofuel from palm oil. While palm oil is cheaper than other sources, Shell discovered that it couldn't acquire any without destroying rainforest. The move was a short-term hit to Shell's pocketbook, but a longterm investment in sustainability.

The right framework may not be there yet, but at the most forward-looking companies, the right thinking is. And perhaps that's the most encouraging sign yet that our future will be okay after all. —Alan Cohen

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— MICHAEL W. PESSINA, PRESIDENT OF THE OFFICE OF PRODUCT DEVELOPMENT, LUTRON ELECTRONICS





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