

The Green Solutions Ecosystem



A few decades ago, Kermit the Frog lamented, “It’s not easy being green.” He must be a much happier frog today.

Suddenly, green is everywhere. Every magazine or newspaper has some advice on how to live a more environmentally friendly lifestyle. Every home improvement show seems to tout the benefits of green construction. Every cooking and gardening show expresses reverence for organic foods. Practically every company seems to be publicizing its fuel-efficient products, its green corporate headquarters or its sweeping new sustainability initiatives.

But where is all of this new talk about the environment leading? What technologies are helping to improve the environment now? Which ideas represent the growth industries of the future? These questions become harder to answer with each new press release, each new technology development and each new launch of a green product or service. Winslow has been analyzing the field and arranging our own thoughts about the many new green products and services available—what we call the Green Solutions™. This white paper explores Winslow’s framework for organizing this very important but often confusing new world.

Environmental Problems, Green Solutions

It’s clear that we are in the midst of a global environmental crisis. Winslow has long held that climate change is one of the most serious challenges that society has ever faced, and it will take global cooperation and effort to successfully overcome it. While we don’t think that we will be able to effortlessly innovate our way out of climate trouble, we believe that a combination of new technologies and changed behaviors will allow us to adequately adapt to our changing climate, as well as slow the rate of change and hopefully someday even stop it.

Climate change is not the only environmental problem we are facing, of course. At home, Americans are still faced with air and water pollution despite decades of regulations, and we still use, and waste, far too much water, energy and natural resources. Just as important, developing nations such as India and China now face dire environmental consequences as their economies rapidly industrialize. The planet can no longer defend itself against this rising global tide of environmental degradation – the developed and developing worlds must address these challenges together.

With every challenge, we see a market opportunity and a host of companies emerging to help society tackle climate change and other environmental problems. Winslow refers to the products, technologies and services produced by these companies as “Green Solutions,” and we have developed our own ecosystem to organize these Green Solutions into seven groups, or communities, to speak in ecological terms. But like a real ecosystem, there are intersections, overlaps and dependencies. Ours is a fluid model that we will continue to update as new trends emerge. Given the pace of change in these rapidly growing markets, we will continue to redefine our communities and even establish new ones in the years to come. We see all of these communities growing in both the near and distant future, and seek the most promising investment opportunities in them all.

Clean Energy

Almost daily, the news about climate change gets worse as scientists discover severe impacts on weather patterns, ice caps and animal and plant adaptation. At the same time, demand for energy continues to grow globally, with the industrialization of developing economies and the ongoing drain on finite oil reserves. For these reasons, and as more fully explained in our January 2007 edition of the Winslow Environmental News, we believe that a major shift from fossil fuels to new energy is inevitable.

To address climate change, we will need energy that minimizes further damage to the natural environment. So the first community in our green solution ecosystem is clean energy—products or services associated with generating electricity, either for the electricity grid or distributed generation, with reduced green house gas emissions. We consider this group to contain a wide variety of companies, including but not limited to, those that:

- Manufacture solar panels, wind turbines, fuel cells or similar alternative energy production systems or components at the utility or smaller scale;
- Produce bio-fuels or bio-gas;
- Operate or develop geothermal, run-of-river hydroelectric, biomass, wind energy or similar low-carbon energy generating projects; or
- Produce the many technologies that are necessary for other Clean Energy companies to manufacture their own products and generate, store or transmit energy.

While most people agree that solar panels and wind turbines provide clean energy, there are a few sources whose impact is more ambiguous. Nuclear energy, in particular, has re-emerged as quite controversial within the climate change context. Supporters tout it as seemingly carbon emission free. However, other environmentalists, we among them, believe this is not a totally accurate picture: mining uranium and building and decommissioning nuclear power plants are not carbon neutral activities. Even more significantly, the key issue of radioactive waste disposal has yet to be resolved. Consequently, while we recognize that nuclear power may be less carbon intensive than fossil fuel-based energy, we do not currently consider it to be a Green Solution.

The question of “clean coal” as a Green Solution is even more complicated. Because of the abundance of coal –particularly in the U.S.—and the existence of a significant coal-burning infrastructure, we acknowledge that coal will be a part of our energy supply in the near- to mid-term future. However, coal is the most carbon intensive fossil fuel; it emits a variety of other pollutants, such as mercury and nitrogen and sulfur oxides; and mining it effectively destroys the land from which it is extracted. In response, a number of companies are developing technologies that they claim use coal in a more environmentally friendly manner. While we don’t think any coal is really clean, we do think that some of these technologies may provide green solutions. We think coal technologies might be green if they can be used at existing plants rather than requiring construction of new power plants, or if they have definite and provable environmental and energy benefits, compared to traditional coal-fired power plants.

Biofuels are another group of technologies that we carefully weigh. Similar to clean coal, some biofuels, including some bio-diesel and some bio-ethanol, may be green solutions. In general, we believe that any biofuel that is competing with food for its feedstock is not green, while biofuels made from non-food agricultural products and wastes may be. We also don’t think that cutting down rainforests to plant raw materials for biofuels is a

Clean Energy Example – First Solar First Solar produces solar panels that do not require the use of polysilicon as a semiconducting material. Solar-grade silicon has become very expensive and has a huge impact on the current cost-efficiency of solar power generation. Analysts predict that First Solar may become the first manufacturer to achieve ‘grid parity’ with retail electric power – in other words, offer an overall cost structure that is cost-competitive with traditional electric power plants even when government subsidies are removed from the equation.

viable green solution, and so carefully investigate the feedstock sources of biofuel manufacturers. Another factor we consider is “energy balance,” the difference between the energy produced by the fuel and the energy it takes to produce it from its feedstock.

We don’t claim that this is an exhaustive list of types of clean

energy. We also don’t expect any one of these technologies to be the entire solution to this large problem, but we think they will all contribute. As Mike Eckhart, chairman of the American Council on Renewable Energy, has told us, with regards to climate change, “there is no silver bullet – but we’ve got a lot of silver BB’s.”

Environmental Services

There is no doubt that the air, water and land in developed nations are much cleaner than they were fifty years ago, thanks to decades of environmental regulations. But the era of regulations is not over, as scientific advances have also led to the recognition of harmful pollutants that haven’t been regulated. For example, we have long known about the danger posed by larger sized particles emitted into the air by combustion processes. And emissions of these particles – from coal-fired power plants, for example – have long been regulated in the U.S. under the Clean Air Act. However, we are only now beginning to understand the detrimental health effect of the smallest of these particles, whose tiny size of less than 2.5 micrometers in diameter allows them to pass into the body. The Environmental Protection Agency only issued the final rule regarding these particles in 2007.

In developing countries, the problem looms even larger. Athletes and officials are worried about the air quality during the 2008 Beijing Olympics, and whether some of the more grueling outdoor endurance events can even be held in Beijing. Some speculate that China will actually need to suspend industrial activities during the games to prevent toxic air quality from harming the athletes.

Pollution abatement, remediation and containment may not be as glamorously green as clean energy, but we believe that these and other environmental services also act as a key community in the Green Solution ecosystem. Today, there are many types of companies that provide a wide variety of environmental services, beyond the traditional waste management companies. This new breed of environmental services includes, but isn't limited to, companies that:

- Manage waste in an environmentally responsible manner, with significant involvement in recycling, waste-to-energy or other beyond-landfill solutions;
- Control pollution from or reduce the environmental impact of energy generation and general industrial activities;
- Remediate existing environmental contamination in an environmentally responsible manner;
- Assist companies in assuring or returning to environmental regulatory compliance, planning growth in an environmentally sound manner or improving environmental management; or
- Trade carbon credits or manage carbon credit-generating projects under a greenhouse gas emissions trading scheme.

We believe that the demand for these environmental services will continue to increase over time. From a global perspective, as populations continue to migrate into cities and demand “Western” lifestyles, management of high-density environments will continue to play an increasingly important role. Forward-thinking service providers will reap the benefits. Corporations, too, will need these service companies to help them meet current environmental requirements and plan for new ones. We believe that the services these companies provide are a necessary, but often overlooked, Green Solution.

Environmental Services Example – Casella Waste Systems Casella provides integrated waste management and recycling solutions to communities in the eastern U.S. It seeks to drive growth through innovation, such as its GreenFiber unit which generates insulation from recycled waste, its joint venture program to develop biofuel facilities and its single-stream recycling initiatives.

Resource Efficiency

Almost all of our environmental problems result from our use and misuse of resources – fossil fuels, natural resources, minerals, land, water and energy. Therefore, reducing our use of these resources can, and will, be one of the most effective ways to combat degradation of the environment and climate. We believe that resource efficiency – cutting the amount of resources needed to achieve a desired result – may be the most

under-appreciated community in the Green Solution ecosystem. We consider resource efficiency to include a broad array of products, technologies and services, including but not limited to those that:

- Enable users to consume less energy or resources through technologies or products that work more efficiently than traditional counterparts;
- Reduce the demand for electricity by working with end users to curtail usage at times of greatest demand (referred to as “demand side management”);
- Monitor or meter resource use to enable informed decisions about usage and upkeep; or
- Keep used materials in the useful cycle by collecting, reprocessing, recycling or reusing pre- and post-consumer materials.

Resource Efficiency Example – EnerNOC EnerNOC is a leading player in the new market for “demand side management” services. Essentially, they operate a computer network that can reduce power demand at specific locations for utilities during peak usage periods. Utilities are willing to pay attractive rates to anyone who is able to provide relief to their power grids during these peak hours, and EnerNOC splits these payments with their commercial and industrial customers.

We believe that resource efficiency technologies are crucial to many of the environmental challenges we are facing. By reducing the amount of water, energy and materials we use, we will reduce the pollution – and the costs – that comes with accessing, generating and transporting those resources. We expect these

types of Green Solutions to grow in prominence as both consumer and policy awareness of the benefits of reduced consumption of resources continues to increase.

Water Management

For most Americans, water just comes out of the tap or from a bottle – the concept of water scarcity doesn’t have any real meaning for us. But the reality is that clean water is an increasingly precious component of almost every economic activity, from agriculture to tourism to manufacturing, as well as a necessity of everyday life. Both in the U.S. and internationally, extreme weather – possibly triggered by a changing climate – has produced both extreme droughts, such as the one that has decimated Australia’s 2007 wheat crop, and deadly flooding, such as the misery experienced across South Asia in the summer of 2007. At the same time, warming temperatures are shrinking the glaciers whose summer-time runoff has long been relied up to provide water for drinking, irrigation and hydro-electric power in many parts of the world. Meanwhile, demographic trends are leading to other troubling situations. In the U.S., population growth is highest in the Southwest, an arid corner of the country that has very little naturally occurring water for its expanding municipalities and metropolises. China, facing a similar situation, is considering building a massive canal from its south to its increasingly arid, but agricultural, north.

Finding and creating new sources of usable water has become extremely important, as water tables continue to drop and water demand continues to grow. But responsibility for water does not end with procurement – water must be safely and cleanly delivered,

and safely and cleanly treated after use. For these reasons, we believe that improved water management will play a major role in the Green Solutions ecosystem, including companies that:

- Build or manage water or wastewater services or infrastructure for municipal, residential, commercial or industrial customers;
- Offer water purification technologies or services such as desalinization, membrane filtration or UV disinfection;
- Reduce the amount of water needed to produce agricultural or industrial products; or
- Provide water management or conservation technologies and services.

We believe that in the not-too-distant future, water technologies that seem unnecessary now will be quite important. Many people now think that desalinization is too expensive and energy intensive to be taken seriously, and wastewater reuse is too far-fetched. But Australia, faced with a multi-year drought that many fear is a result of climate change rather than a temporary condition, is beginning to use both of these technologies. In the southeast, the city of Perth opened a massive desalinization plant to provide the city with drinking water in late 2006, powered by a nearby wind farm. In the states of Victoria and Queensland, projects are under construction to supply industrial customers with reclaimed wastewater, to ease the pressure on drinking water supplies. We believe that as the impact of global water scarcity grows, projects such as these will be much less rare and much more affordable.

Water Management Example – Basin Water

Basin Water is a specialty provider of solutions for treating contaminated groundwater, primarily serving state and municipal water agencies throughout the U.S. It offers a next-generation ion exchange system that is capable of treating water at the source or in a centralized facility; ion exchange is approved by the EPA as a “Best Available Technology” for arsenic, nitrate and perchlorate removal.

Green Building

Buildings may seem a static, neutral component of our world, but they’re not. Buildings have a huge impact on both their inhabitants and their environment. The buildings we work, play and live in are responsible for as much as 42% of the energy used in the U.S., not to mention 40% of the air pollution and 25% of the solid waste generated according to the EPA. Over the past decade, and the past year in particular, the idea of designing buildings that harmonize with the environment has been expanding rapidly, creating a growing market for companies offering green building products and services. Winslow first wrote on this trend in a June 2006 white paper titled Buildings for a Greener Planet, and we have only seen interest in green buildings grow since then. Green building companies include those that:

- Provide preconstruction services designed to minimize the environmental impact of building;
- Offer energy, heating or cooling systems designed to reduce a building’s energy usage;

- Manufacture efficient lighting technologies or systems;
- Produce insulation, efficient windows or other methods to prevent unwanted heating or cooling of a building's usable space;
- Create environmentally-friendly building components, paints or furnishings, such as those made out of recycled or sustainably produced materials or those that contain lower amounts of chemicals; or
- Manage, or invest in, green buildings.

Green Buildings Example – WFI Industries WFI Industries (formerly Water Furnace International) is a leading provider of geothermal HVAC systems. These geothermal systems use the consistent 55°-70° temperatures a few feet below ground to provide heating and cooling, and typically operate at 300-500% efficiency when compared to traditional heating methods. Awareness of geothermal HVAC is just starting to take off among mainstream builders, and WFI owns a 30% share of the market in the U.S. within this rapidly growing product category.

We believe that green buildings offer an easy and often cost-effective way to improve indoor air quality and quality of life, while often also reducing climate change contributions. According to the U.S. Green Building Council, the non-profit center of the U.S. green building industry, green building was mostly a gleam in a few visionaries' eyes only a decade ago but is now

worth over \$12 billion, and continuing to grow.

Green Transportation

Moving people and objects – whether by car, truck, bus, plane or boat—is currently almost entirely dependent on fossil fuels, primarily oil. Both the E.U. and U.S. have noted that between a quarter and third of their greenhouse gas emissions come from transportation, including shipping and aviation. If we are to fight climate change as well as wean ourselves from foreign oil, a dramatic redefinition of global transportation is highly desirable. We believe a shift to green transportation is already beginning, and will continue for decades. Components of the new transportation community will include companies that:

- Operate, service or equip mass transportation systems;
- Manufacture vehicles or components that reduce usage of fossil fuels, such as hybrid or electric vehicles;
- Produce technologies to increase vehicle efficiency or control emissions; or
- Provide advanced batteries or other components of advanced and efficient vehicles.

According to a 2006 Department of Energy study, the rise in greenhouse gas emissions from transportation in the U.S. over the past twenty years can primarily be attributed to the increase in the amount of miles driven to transport people and freight. According to the report, in 2000, 76% of Americans drove to work by themselves, compared to 5% who took public transportation. DoE also notes that transporting one ton of freight one mile by truck requires 11 times more energy than it would take to move the same freight the

same distance by rail. Any change to get people or freight out of cars and trucks and into trains – or even buses or ships, according to DoE – is therefore highly desirable, from a climate standpoint.

Green Transportation Example – Borg Warner

Borg Warner is a specialty developer of advanced engine and drivetrain technologies, and is a leading supplier to several major auto manufacturers. Many of their technologies, such as all-wheel drive systems, dual clutch transmissions, and powertrain technology bring the benefits of improved fuel economy, reduced emissions and enhanced vehicle performance and stability.

We believe that as the price of oil and awareness of climate change

both continue to rise, our transportation infrastructure is beginning an evolution away from fossil fuels. While we don't know what will be powering new cars twenty years from now, we do know that some of the new cars sold today will still be on the road then. We believe that companies that are tweaking our current modes of transportation for increased efficiency, as well as those designing the next generation of technologies, will all play important roles in the green transportation revolution.

Sustainable Living

As environmental awareness has grown over the past few years, increasing attention has been paid to the environmental consequences of individual decisions. Many people are no longer content to consume products grown with chemical fertilizers and pesticides that contaminate the environment and may linger to contaminate the body. A new trend towards sustainable living is emerging as consumers consider the impact of the foods,

Sustainable Living Example – Chipotle Mexican Grill

Chipotle Mexican Grill is a rapidly growing chain of Mexican restaurants. Whenever possible, they use all-natural, organic and locally sourced food ingredients and have extremely high standards in terms of treatment and support of their employees. We see them as an excellent example of how environmental and financial performance can go hand-in-hand – their high quality foods allow for premium pricing and are a key driver of same store sales growth. Operating 640 restaurants nationwide, Chipotle represents one of the only national restaurant chains with an overarching dedication to natural, locally sourced food ingredients.

goods and services they use on both their own personal environment and the broader natural environment. This heightened awareness, coupled with an aging population more focused on its health as well as growing scientific concern over many common chemicals, has resulted in ever-increasing demand for organic, natural and healthy products. These related trends provide opportunities for many Sustainable Living companies, such as those that:

- Produce, manufacture, distribute or sell organic or natural foods and products;
- Manufacture complementary medicines; or
- Provide products or services focused on increasing individual health and wellness.

Organic crops are grown in ways that mimic nature, using natural pest and weed control and more frequent crop rotation. Such practices results in clear environmental benefits, including decreased or eliminated runoff of fertilizers and pesticides, and the elimination

of trace residues of these chemicals in the foods people consume. Sales of organics have increased by more than 15% each year for the past 10 years, and now represent about 3% of U.S. food sales. We believe that this growth demonstrates the dramatic shift in how people are approaching their lifestyle decisions, and that it is an indicator of future growth for the entire Sustainable Living category.

A Green Shift

We believe that American and global societies are in the midst of a green shift. Led by growing awareness of the increasing urgency of climate change, both individuals and societies are increasingly taking into account the environmental impact of choices, both large and small. We believe that over the coming decades, many of our current, and wasteful, practices will be replaced by low-carbon, low-impact counterparts that will allow us to do more with less, to keep developing and growing while decreasing our impact on our natural environment. Our Green Solutions Ecosystem is our way of keeping track of the rapidly growing market of companies taking part in this green shift. As citizens who have long been concerned about environmental crises such as climate change, we are inspired by the progress that we see. And as investors, we are excited by the number of Green Solutions companies that are turning environmental challenges into business opportunities.



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