

**Embracing Sustainability
New Knowledge, New Policies, and New Goals for the
21st Century**

**By
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September 19-22, 2006

It is a privilege to be in your country for the first time and to discuss with you a challenge facing the United States, South Korea and virtually every country on our small planet: finding ways to live and do business that are environmentally sustainable.

In reading your country's report, *Green Korea 2005*, seeking the harmonization of humans and nature, I was most impressed by the breadth of policies and initiatives being taken aimed at shaping a sustainable future. I hope that the thoughts I share today will be useful in your continued planning and that, in our discussion, we can learn from each other and identify areas in which exchange of information and collaboration may be valuable going forward.

I would like to focus on several aspects of the sustainability challenge today:

First, the remarkable knowledge revolution – perhaps the greatest achievement

that has occurred over the last 35 years since the first Earth day was held in the United States – regarding the environmental problems facing our world.

Second, the creative new policies that are now being framed as our evolving knowledge has revealed the scale of changes that must be made to move effectively toward sustainable ways of living and doing business.

Third, the progress being made in an area that certainly represents one of the industrialized world's greatest sustainability challenges – addressing the highly polluting and resource-depleting impacts of the 600 million cars, buses

and trucks traveling the world's roadways – (Through this brief case study, I'd like to reflect on the steps forward we have made in understanding the nature of this challenge and in shaping policies that are beginning to stimulate a shift to the non petroleum-based fuels and vehicles of the future. However, our experience in this area, as in other areas, reveals that more than in depth-knowledge and good policies will be needed to inspire broad change on the ground – where it counts.)

Finally, I would like to reflect on the key added ingredient needed for societies to truly embrace changes moving toward sustainability: building leadership into the citizenry through strong environmental education programs for families, communities, and, most of all, for our young people. It is only the commitment, enthusiasm and action of individuals within all public and private institutions that will actually catalyze broad basic change.

The perspectives I share today come from the more than three decades I spent as founder and President of the US environmental research organization, INFORM, which analyzes environmental problems largely, but not exclusively, in the US. Through studies of business practices, technologies, and products in areas where they are generating significant pollution and waste or depleting natural resources, the main goal has been to identify avenues for innovation that could “prevent” this waste and pollution at the source. As a pioneer in stressing “preventive” solutions, INFORM's research, published in more than 100 reports, has been widely used by government, business and environmental leaders across our country and increasingly elsewhere. In the US, our four year analysis of the chemical manufacturing industry inspired the groundbreaking 1990 Pollution Prevention Act and many subsequent state pollution prevention laws. For this work, INFORM received the US Environmental Protection Agency's highest leadership award.

My new organization, Underwood Energy Associates, formed this year, will be concentrating on the issue of sustainable transportation – promoting an end to the world's addiction to oil-derived fuels and a shift to the era of pollution-

free hydrogen-powered vehicles. Now let me turn to the topics on my agenda today.

1) The Knowledge Revolution that has occurred since 1970 about the Environmental Challenges facing our World

The expansion of knowledge has been perhaps the greatest achievement of these past several decades, and provides a basis for hope as we look to the future. **Where were we in the United States in 1970?** In 1970 Americans has soaring enthusiasm for safeguarding the environment which was reflected in our “Earth day” celebration. The US Congress passed the first national environmental laws and established the US Environmental Protection Agency (EPA) to implement them.

We had enthusiasm in 1970 -- but we had very limited knowledge. We saw that there was too much litter on our streets, too much smoke coming out of factory smokestacks and too much waste flowing from industrial outfall pipes. There were too few landfills, waste treatment plants and incinerators to handle our wastes. And, in seeing our government pass the clean air and water laws and set up a lead agency in Washington DC, we felt great confidence that these problems could be solved.

The new EPA, as mandated by Congress, would identify the major forms of visible pollution and waste and set standards to restrict these. Standards would be established that would be based on identifying a protective level of exposure to a polluting substance and adding a “margin for safety.” Business leaders, with their engineering and scientific skills, would design new pollution and waste management systems, and the challenges would be met. (Can you imagine that one much talked of strategy in those early days was the strategy of building

“tall stacks” for industrial facilities so that all the pollution would blow AWAY!)

We anticipated rapid change. Our goals? Air would be healthy for all Americans to breathe by 1975. There would be zero pollution into US waterways just a decade later.

What have we learned since then? A LOT! Of most importance, we have learned how greatly we underestimated the nature of our environmental challenges. They are not just getting rid of waste and pollution (the by-products of industrial activities) but about rethinking the underlying industrial processes at the heart of our economy. It is these processes that are depleting a natural resource base on which a healthy economy relies, releasing contaminants that are undermining the fabric of our life support systems, and, in short, threatening our future.

We have become aware that much of the contamination and waste problems we are facing have their roots in the massive reliance of our country and other industrial nations on fossil fuels. Yet, this reliance is a relatively new historic phenomenon. It began only in the mid – 1800s. Before then, energy came from food, animal labor, wind and water. Then we found coal and then struck oil, and in the ensuing 150 years (just a tiny moment in history) there was a dramatic shift in our economic activity:

- Energy systems were soon virtually all fueled by coal and oil
- Transportation systems came to be all run on petroleum-derived fuels. Since the 1890s American travel went from reliance on 25 million horses to reliance on 220 million gasoline or diesel-powered cars, buses and trucks today (more than 600 million globally). We got around more rapidly and easily than ever before.
- The use of oil was harnessed for the manufacture of synthetic chemicals. In barely 70 years, more than 210,000 chemical plants were

built in the US that today make or use 80,000 synthetic chemicals – many that never before existed on the face of the earth. The chemical industry gave us a remarkable world of new materials and products – from plastics, adhesives, paints and life saving pharmaceuticals to nylon stockings, nail polish and home cleaners. It also harkened in the era of disposables.

But in the last 25 years, we have begun to see the downsides of our many ingenious uses of fossil fuels.

- Citing the US whose conditions I know best, vehicle emissions, despite the efforts of the auto industry to reduce them with modern catalytic converters, and a ban on lead in gasoline, now make up 60 to 90 percent of urban air pollution. This pollution is largely responsible for the fact that more than 150 million Americans live in areas where the air is labeled by the EPA as unhealthy to breathe. These emissions are putting at risk the health of a generation of children. Diesel emissions from trucks and buses are a primary culprit in the virtual asthma epidemic sweeping our cities and many cities elsewhere in the world. Between 1980 and 1994, in the US asthma rates rose by 75% overall and by 160% among children under four. (Asthma is the leading cause of children’s absenteeism from schools today.)
- A growing number of leading public health-related organizations have also linked diesel emissions with rising cancer risk. California’s Air Resource Board declared diesel particulate exhaust to be a toxic air contaminant, containing more than 40 “known” or “probable” carcinogens or reproductive toxicants. The US National Institute of Occupational Safety and Health (1988) and the World Health Organization’s International Agency for Research of Cancer (1989) have come to similar conclusions. Children, whose developing systems are most vulnerable to toxic impacts, are doused with diesel particulates, especially in cities, by trucks, transit buses and their own school buses.

- Fossil fuel burning, as you are well aware, is also a central cause of the greenhouse gas emissions that are now visibly causing changes in our global climate – a warming trend, accompanied by violent weather shifts, melting polar ice caps, rising sea levels, and much more. This may be the greatest threat to our children’s future.
- Growing competition for global oil supplies – largely for transportation use -- is becoming a source of international conflict, putting the US, which has been the world’s most voracious consumer of world oil for most of the 20th century, on a collision course with China, India and other industrializing Asian nations who are seeking their share of this dwindling resource.
- Finally, the skyrocketing growth of synthetic chemical production in the US (6 trillion pounds of chemicals flow into commerce each year!) and the pervasive use of these compounds, as well as heavy metals, in consumer and business products has raised steadily expanding concerns about their impacts on human health.

If there is anything encouraging in this picture, it is the recognition among more and more nations that this fossil fuel-based way of living is not sustainable for those in the industrialized world – let alone replicable for the billions of others who aspire to follow this path to achieve the same standard of living.

Today’s challenge is to draw on business’s creative energies – the energies that gave us the fossil fuel-based innovations of the 20th century – to give us the innovations we will need for a new era. This means a major transformation of our economy: rethinking the pervasive use of toxic chemicals overall (Where is their use making a vital contribution to life and where can we find safer bio-based products instead?); finding ways to shift from reliance on fossil fuels for powering energy and transportation systems to renewable and solar energy resources -- to pollution-free hydrogen. The overall goal: designing a new generation of pollution-free

industrial processes and toxic-free and resource-efficient products. Now this brings me to my second topic.

2) Shaping New Environmental Policies for the 21st Century

Government policies of the 1970s and 1980s focused on mandated strategies for waste management, disposal and recycling, and policies of the early 1990s expanded to include mandates and incentives to drive industrial pollution prevention. While all of these remain vital, they have proven inadequate since they assume the continued massive use of fossil fuels and synthetic chemicals as basic to a sophisticated industrial economy.

The good news is that, given today's knowledge, we have begun to create policies aimed at driving a major transformation in the products we use, including how and with what they are made. **Products**, after all, are the reason for all that industrial activity. Mining and extraction of resources transport, and production facilities are just the ways to create the products and technologies that then go to market. Product-related policies can impact the whole chain of industrial activity. Over the last decade interest has grown in policies aimed in this direction: I have noted with great interest that some of the ideas that we originated in the US are being put to use here. Of greatest importance, I would focus on:

- Public information policies of two kinds: First, policies requiring industries to report to government and the public annually on the toxic substances they use and the emissions they generate. Varieties of the Toxics Release Inventory, first established in the US in 1986, are now in use in many countries. However, let me note that the original proposal made for this chemical database in the US was not just for a toxic "release" inventory but for a "materials accounting" inventory that would have required companies to report chemical-specific data on the chemicals entering a plant each year as feedstock, the amount sent out in its products, the amount consumed in production, and the amounts leaving to be treated, recycled or managed as waste. Because

government at that time only considered wastes an environmental problem, the chemical industry argued that it should not have to report on feedstocks entering its facilities or on what went into its products. The industry's argument at that time won the day. In the 20 years since then, it has become clear that much (if not most) of the toxic chemical contamination in our environment comes from toxic chemicals in products – not waste. So you might look at the TRI in South Korea and consider broadening it to create a fuller picture of the movement of toxic materials through your economy.

The other powerful information policy is product labeling. Both types of policies allow citizens, communities, environmentalists, and investors as well as regulators to shape their views and make decisions regarding companies and products on the market. (A saying that we have in the US applies here: “Sunshine is the best antiseptic.”)

- Second are policies making businesses responsible for their products when these would become waste – using the principle of Extended Producer Responsibility. EPR policies were first applied in Germany in its 1992 packaging legislation. They are now spreading around the world. Saddling the companies who make and sell products with the costs of these products when they would become waste is proving a powerful driver for the redesign of products to contain fewer toxic constituents and to be more re-usable and recyclable. Ideally, when the products are disposed of, they would enrich rather than degrade the environment.
- Third are Green Purchasing Policies: Applied by government agencies, other institutions, communities, and now by some businesses, green purchasing policies give preference to products that are considered by the purchasers to be environmentally preferable. Guidelines for purchasing may call for products to be free of toxic chemicals or heavy metals, made with recycled content and/or made so they are recyclable. In some cases green purchasing policies favor products that the

manufacturers agree to take back and reuse at their end of life. All such policies reward innovative companies by ensuring a growing market for many new types of products: toxic-free cleaners, paints, building equipment, plastic packaging made from corn-based polylactic acid or other bio-based resins, and much more. And purchasing policies are easier to put in place and to revise than mandates.

- Public programs that recognize and reward companies who are making “green products or operating “green” offices or factories also create a positive climate for innovation.

Yet even with these important and well focused new approaches, progress is proving difficult. My brief reference to the sustainable transportation revolution shows why.

3) A Look at the Sustainable Transportation Challenge: What Knowledge and New Policies are achieving and What Obstacles impede Progress.

Knowledge in the 1970s in the area of transportation focused in the US on one problem: the air pollution generated by vehicle emissions. And the policy approach, of course focused on “by-products,” mandated tailpipe controls to trap those emissions. Over the last 35 years, as discussed earlier, we have learned that there is much more at stake: the huge emerging issue of greenhouse gas emissions to which vehicles are a major contributor; the essential limits to the world’s oil supplies (most experts in and outside of industry see this resource peaking between 2008 and 2030), and certainly prospects for world peace and security.

After 35 years of expanded understanding, there is increasing agreement that the world will have to move away from high carbon oil-derived fuels to

carbon-free renewable resources and ultimately, perhaps, to efficient fuel cell technology and pollution-free hydrogen. In the remarkable fuel cell, which - like a battery - is a “carrier” of energy, hydrogen is merged with oxygen through an electrochemical reaction, releasing usable energy as electricity and a few drops of water as the only byproduct.

The question has been what do we do today to get there? Our research at INFORM in this area has played an exciting role as we sought to chart out what might be the most direct path to a sustainable transportation future. It is evident that two fundamental system shifts are needed: a shift in the propulsion system from the conventional inefficient internal combustion engine to more efficient engines, and a shift from reliance on petroleum-based, high-carbon gasoline and diesel fuels to renewable fuels and ultimately to carbon- and pollution-free hydrogen. And we have concluded that two of the exciting areas of vehicle innovation today may contribute most in both near term benefits and benefits related to a long term transition to hydrogen-powered transportation.

With regard to new propulsion systems, the hybrid electric vehicles, such as the Toyota Prius, the Honda Civic hybrid electric sedan, and Hyundai’s Sonata have that combination of near and long term benefits. In the near term, hybrid electric vehicles are conserving the world’s remaining oil resources by using fuel so much more efficiently – getting from 40 to 90 miles a gallon. But additionally, as their use expands, vehicle makers are refining the sophisticated electronic systems that will be needed in the electrically driven power train of commercial fuel cell vehicles. When fuel cell vehicles enter the marketplace in the years ahead, it will be in part thanks to development of today’s hybrids.

As far as the fuels transition away from oil-derived fuels goes, a variety of fuels such as ethanol and bio diesel made from renewable bio-based resources can help displace gasoline and diesel. However, for its combination of near and long term benefits, natural gas has emerged as the clear winner. In the near term, natural gas – much lower in carbon than petroleum (20%

versus 39%), reduces vehicle emissions greatly, and since it is a fully commercial choice today for all kinds of heavy duty bus and truck applications, it can reduce emissions where this is most critical, in urban centers. While natural gas is still a deplete-able resource, it is more widely dispersed in less volatile regions of the world than oil. In addition, it will soon be a resource supplemented by renewable bio-methane fuel produced from landfills, sewage treatment plants, and agricultural wastes.

Turning to the long term, natural gas use in vehicles is helping accelerate our shift to hydrogen. This is because, as it is being used in an expanding population of vehicles, systems for storing, transporting and delivering a pressurized gas fuel to vehicles are being refined, which will be adaptable for handling hydrogen gas. In addition, much of the infrastructure now being set up to refuel natural gas vehicles will be able, with additional gas extraction and compression equipment, to produce hydrogen, which can then be used to make a super-clean 80/20 percent natural gas/hydrogen mix or used as pure hydrogen for powering the first generation of fuel cell vehicles.

Public mandates requiring the use of advanced natural gas transit buses and also refuse trucks are helping build these important markets. China and India are way ahead of the US in purchasing natural gas buses. And I was very pleased to learn that Seoul already has more than 2000 natural gas buses and has committed to having all 8,000 of the City's buses powered by natural gas by 2010. Paris, France, Madrid, Spain and 57 US communities have led a shift to quiet and clean natural gas refuse collection trucks.

In addition to mandates, an array of economic incentives established under the new energy and transportation laws passed in the US in 2005 will give all advanced and non-petroleum fuel vehicles a large economic boost. Green purchasing policies applied by governments and other public institutions will help as well. And EPR policies are leading automakers to eliminate toxic materials and improve the recycle-ability of vehicles at their end of life.

However, despite the evident potential that hybrid electric and natural gas vehicles have for challenging the prevailing transportation paradigm in communities around the world, they have barely made a dent in US or world markets. The close to 5 million hybrids and natural gas vehicles in commerce -- represent just a tiny fraction of the still swelling ranks of gasoline and diesel powered vehicles sold today. Clearly, the weight of today's established oil and transportation interests is the greatest drag anchor on progress. So what can overcome this factor? What can accelerate change – especially in a world of still soaring population (a world forecast to have 9 billion people by 2050 – a 50% increase from 1999 in just 43 years) and rising economic expectations? That brings me to my final topic.

4) Building Leadership into the Citizenry: The role of Environmental Education in Embracing Sustainability.

My 35 years of environmental research and outreach has convinced me that even with knowledge of the path to a sustainable future, with incentives and mandates being created in the transportation arena and others, and the sophisticated technology and scientific skills of the private sector, it is the commitment, enthusiasm and engagement of citizens as well as leaders that is essential to turning the tide. Environmental education of families, communities, and especially the young who will be tomorrow's leaders is key.

While school courses are important, the education of our young people must be provided through formal instruction in schools as well as “learning by doing” and learning from the example set in families and communities e.g. formal and informal education. It must involve both study and observation of nature and natural systems and also interaction with nature. It must involve academic study of waste and contamination problems and also actual field observation of wastes and undertaking waste problem-solving initiatives. It must involve academic science studies and also actually conducting experiments in scientific and technology innovation.

The best way to learn about “green products” is through spending time in homes or schools that are “green buildings” and in which “green products” are used.

At INFORM, we emphasized resources – manuals -- enabling students and/or communities to actually get out and do environmental problem-solving projects. Using our manual *Making Less Garbage on Campus* college student teams were able to inventory what their schools buy and use and to examine waste prevention opportunities. Using a simple community planning guide, citizens concerned about their children breathing unhealthy air have been able to actually undertake planning a project to bring natural gas school buses or refuse trucks or taxis to their towns. Using a manual entitled, *Cleaning for Health* schools, other public and private institutions have been able to shift from toxic chemical-containing to toxic-free cleaning products. We have found that through such action-oriented projects sustainability values can be rooted and grow.

Young people, families and communities must feel the excitement of accomplishment: whether it is making their garden grow, seeing clean quiet natural gas buses on their streets, or choosing non-toxic products for their home.

Looking Ahead

We have seen a revolution in knowledge and a revolution in public policies in the last 35 years. But now is the time when we must place a high priority on taking steps that will truly reflect a commitment to conserving the resources on which the future of our global family relies – concrete steps that demonstrate for others and ourselves that we are indeed embracing sustainability. And for each of our nations, we must recognize that the path ahead begins at our own doorstep.

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