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# Green Technology: Think Globally, Act Locally

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“Green Technology: Think Globally, Act Locally”  
Remarks at the Green Innovation Forum in Tokyo, Japan  
“Promotion of Green and Global Innovation”  
October 12, 2010

Ohayo gozaimasu!

I consider it a great honor to be invited to speak at this 30<sup>th</sup> Anniversary Forum of NEDO focused on the promotion of green and global innovation. The aims of NEDO to promote new energy and energy conservation technologies, while developing and disseminating technologies that protect the environment, are important contributions to the world.

They recognize an important factor: that energy and environmental sustainability interact as complex coupled systems. One cannot achieve sustainable energy without assuring a sustainable environment. Likewise one cannot achieve either one without assuring a sustainable economy. To achieve any of these aims requires educating our youth and the public at large on the importance of conserving energy and mitigating climate change. I believe that NEDO is providing great leadership in promoting these aims not only in Japan but also throughout the world.

The three approaches employed by NEDO; namely, joint implementation (JI), clean development mechanisms (CDM), and emissions trading (ET) are providing valuable assistance to countries throughout Asia and elsewhere in the world to realize the potential of green technology and the meaning of good stewardship. Through these initiatives, Japan has become a model of leadership in the mitigation of greenhouse gases and as an innovator of more efficient, reliable, and flexible sources and uses of electric power. The term “think globally and act locally” has many authors, including Akio Morita, the co-founder of Sony. I commend NEDO for applying this principle in all of its endeavors.

The term “green” is often interpreted differently by different people concerned about sustainable development. To some it means a striving for a simpler, less consumptive lifestyle. To others it means applying technology to achieve a smarter lifestyle that prevents damage to the environment. Henry David Thoreau, the 19<sup>th</sup> Century philosopher and iconoclast, advocated striking a balance between staying connected with both civilization and nature. I believe that striking such a balance applies to “green technology”.

The potential for climate change mitigation in the United States through “green technology” is great. The U.S. and China rank as the world’s largest emitters of greenhouse gases when

measured on a per capita basis. However, when measured relative to GDP, an indicator of energy efficiency, the U.S. is among the lowest, behind the European Union and Japan, with Japan ranking lowest in the world <sup>(1)</sup>. This should be a source of great pride for all Japanese citizens.

Green, renewable energy is already a major component of energy production in the United States. The U.S. is the world's largest supplier of nuclear energy and leads the world in installed wind power. It also has the world's largest solar energy generating station, and remains the world's leader in installed geothermal capacity. Most cars on the road in the U.S. today run on blends of up to 10% ethanol, and there are already more than 8 million vehicles on the roads designed to run on blends ranging to 85% ethanol <sup>(2)</sup>.

To build on these achievements, the U.S. energy policy acts of 1992, 2005, and 2007 provide substantial tax incentives, loans, and directed funding to reduce dependence of foreign sources of oil and support more clean, renewable energy development <sup>(2)</sup>. In alignment with these acts, the Obama Administration has established the following energy goals <sup>(2)(3)</sup>:

- Provide short-term relief to American families
- Eliminate current oil imports from the Middle East and Venezuela within 10 years
- Create millions of new green jobs, and
- Reduce greenhouse emissions 80% by 2050

As part of this plan the Administration places a high priority on educating more American students in science, engineering and entrepreneurship for careers related to clean energy <sup>(4)</sup>.

This brings me to "acting locally". There is strong public support in the United States for reducing greenhouse gas emissions and the reliance on foreign sources for fossil fuels <sup>(2)</sup>. As a result much of the effort being made in achieving these objectives is occurring on a sub-national basis. For example, over four hundred cities in 50 states, representing approximately 20% of the U.S. population, have adopted the Kyoto protocol <sup>(2)</sup>.

Furthermore, the U.S. Department of Energy and Environmental Protection Agency have issued a national action plan to state policy makers proposing a 50% reduction in energy demand and a reduction in greenhouse gas emissions equivalent to the emissions from 90 million vehicles <sup>(2)</sup>. There are now in place regional coalitions to take aggressive initiatives to reduce greenhouse gases. One such coalition, promoted by the state of California, includes seven states and four Canadian Provinces <sup>(5)</sup>.

The State of California is of particular interest. If California were a sovereign nation it would be the 7<sup>th</sup> largest national economy and the 12<sup>th</sup> largest emitter of greenhouse gases <sup>(2)(6)(7)</sup>.

To reduce this level of emission still further, Governor Schwarzenegger has established policies to promote the use of alternative fuels, the installation of more clean energy, and the creation of green jobs. His actions include measures to incentivize the availability of alternative and renewable fuels, reduce tailpipe emissions from passenger vehicles, promote hydrogen as an alternative fuel, provide tax exemptions for equipment used to manufacture “zero emission” cars, and incentivize the installation of 3,000 megawatts of solar energy systems on homes and buildings <sup>(5)</sup>. Similar programs are being carried out in other regions and states of the Union.

Several U.S. federal agencies actively support research and development in “green technologies”. The U.S. Department of Energy is the dominant federal investor in the research and development of “green technologies”, especially at national laboratories in partnership with universities and other global institutions. The U.S. Department of Agriculture funds large scale research in sustainable bioenergy, and the National Science Foundation (NSF) supports many basic research projects in “green technologies” at universities. I would like to focus on two programs at the National Science Foundation, the agency I led over the past six years, which involve global partners in “green technologies”; namely, The Partnerships for International Research and Education (PIRE) and Engineering Research Centers (ERC).

The PIRE program:

*...funds institution-to-institution, cutting-edge research conducted by U.S. universities in collaboration with foreign counterparts. PIRE supports research efforts that neither side could accomplish on its own...<sup>(7)</sup>*

Examples of PIRE programs that benefit “green technologies” include electron chemistry and catalysis at interfaces; the conversion of biomass-derived reactants to fuels, chemicals and materials; and multiphase fluid science and technologies. These research programs collectively involve partners in China, Denmark France, Germany, and Japan <sup>(8)</sup>.

The Engineering Research Centers (ERC) were established in the 1980s by the NSF to support frontier research in engineering. These centers actively collaborate with industry and international researchers and participate in faculty and student exchanges. Energy, sustainability, and infrastructure, clearly “green technologies”, are among the three major technological areas upon which ERCs focus. Thematic areas of research among these centers include bio-renewable chemicals, efficient fluid power, renewable energy delivery and management, and smart lighting <sup>(7)</sup>.

Other than PIRE projects and ERCs, NSF supports research in advanced fuel cells, batteries, super capacitors, solid state lighting, smart grid, energy storage, hydrogen production, and energy conserving microcircuits at Science and Technology Centers and through multiple investigator grants too many to enumerate in this brief overview. Even from a national perspective these programs demonstrate that “green technologies” are truly in the “global domain.

In terms of both “thinking globally and acting locally”, U.S. universities are also active players on the world stage in the research and development of “green technologies”. Researchers at Purdue University, my home institution, are actively engaged in several “green technology” research projects. Some of these are being commercialized through Purdue-enabled, start-up companies, such as <sup>(9)</sup>:

- Green Tech America, which produces a modified yeast that substantially increases ethanol yields from cellulose by being able to ferment xylose and dextrose in addition to glucose (based on research conducted by Prof. Nancy Ho),
- Sorion Inc., which develops sensors and an active control system that optimizes wind turbine performance under changing wind conditions (based on research by Prof. Doug Adams),
- Swift Enterprises, which synthesizes aviation drop-in fuels from acetone distilled from bio-mass (based on research by Prof. John Rusek), and
- AlGaCo, which produces aluminum-gallium alloys that when reacted with water produces hydrogen on demand to power fuel cells (based on research by Prof. Jerry Woodall).

and others represent large projects:

- Direct catalytic conversion of biomass to biofuels,
- Nanotechnology approaches for improving the efficiency of thin solar cells,
- Modeling and simulations to improve solar cells,
- Developing a hydrogen storage system for cars,
- Biodiesel production from algae, and
- Optimizing energy conservation through “smart metering”.

These are representative of many other projects at Purdue University’s Discovery Park, which supports high-impact, multidisciplinary projects in “green innovations”, especially those that advance the development and commercialization of clean, renewable energy. Purdue University is only one of many U.S. research universities conducting fundamental research on “green technologies”.

In keeping with the theme “thinking globally”, the academic institutions in the United States and Japan are among the greatest “brain trusts” in the world. The collective scientific, engineering and innovation capacity represented by our great seats of higher learning represents an enormous capability for understanding the complexities and consequences of global issues, especially those which could benefit from the adoption of “green” innovations.

I will leave you with this closing question in our shared quest to pursue “green innovations”. What more could we be doing in partnership to “think globally and act locally”?

Arigatou gozaimasu!

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