Luncheon Keynote Remarks
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Last year I spoke at this conference about New York's historic role in energy and innovation, and what we had to do to build economic strength in a complicated and challenging era. Here we are one year later and the era seems to have grown even more complicated and challenging. On top of a jobless recovery from a deep recession, we have what I can only hope will not turn out to be political gridlock at all levels. I'm not here to perform a political analysis or to guess what the impact of the recent elections will be on the future economic strength of the nation or the state. More relevant questions for this conference are: What are the prospects for moving New York's energy agenda forward in these times? Have we made any progress during the past year? Can we find any reasons to be optimistic about the future energy economy?

In the short run, we still have the problem of digging out from the world's worst post-war recession. The recession is officially behind us, but job creation is barely keeping up with the expanding workforce, leaving the jobless rate stuck at 9.6% There is some good news in an increasing availability of commercial and industrial credit, so far mostly available to larger companies, but holding promise for expansion to small businesses during the next two quarters. This is essential for any sustainable job creation.

In the long run the 'energy problem' is the problem of finding resources to enable the world's growing population to live dignified and poverty-free lives without making the planet unlivable for future generations. This is a world problem because the energy economy is about as global as you can get. Whether the driver is energy independence, global change, finite natural resources, or green jobs, agreement is almost universal that we need economically accessible sources of clean energy in every populous country. That means energy technology that countries like India, Africa, and Indonesia can afford. In 2008 Al Gore challenged the nation "to commit to producing 100% of our electricity from renewable energy and truly clean carbon-free sources within 10 years." We know that is not possible, but our experience over the past few years of trying has been sobering.

Fossil energy is cheap energy. Only with government subsidies or other interventions like a carbon tax are alternative fuels going to be able to compete. Some alternatives in some locations seem to be competitive now, or nearly so, but scaling up to an economically significant level is going to be extremely difficult. Take biofuels. In the short run, today in the U.S., that means corn based ethanol. Our current processes for making it are not fuel efficient, and congress has capped the amount of corn ethanol for transportation at 15 billion gallons by 2015. How about cellulosic ethanol, which

captures more of the energy in the plant material? Well, we don't need it because existing corn ethanol capacity is able to meet the need for the current 10% blending requirement with gasoline (This is known as the 'blend wall.') And besides, we haven't been able to bring the cost of cellulosic ethanol production down as fast as estimated – it needs to be cut in half – so even greater subsidies would be required. How long will it take for car makers to have engines ready to run with higher percentages of ethanol, which might create a market to break through the blend wall? We don't know, and neither do investors, who are not very interested in financing cellulosic ethanol production these days.

Solar looks good for the Southwest U.S., and in North Africa there's a plan to wheel electricity under the Mediterranean on efficient High Voltage DC transmission lines. In both cases the power is generated by CSP – "Concentrating Solar Power" which uses the sun's heat, not its photonic energy as in photovoltaic cells. These are capital intensive big ideas, and just now there's no financing available. In all cases where solar power is being deployed or planned, government subsidies and loan guarantees are essential to keep the projects going, but private capital has dried up during the recession and slow recovery, and many of these projects are in a state of suspended animation.

Wind power looks good too, but its theoretical global energy potential is a thousand times less than solar, and distributed unevenly around the globe. Where it is possible, it is increasingly unpopular with the public, the issues ranging from noise to aesthetics. Bird kills are real, and so is interference with ground control radar at small airports. Engineers are working on these problems, but the aesthetics nut is tough to crack. Both wind and photovoltaic solar have unresolved storage problems, and storage technologies – *i.e*. batteries, flywheels, pumping water to uphill reservoirs – are developing slowly.

Nuclear power is increasing, with 53 new reactors under construction world-wide, and interest expressed in about two-dozen new plants in the U.S., all sited near existing plants. But public concern remains high, and issues of spent-fuel storage and nuclear weapons proliferation are unresolved. Nevertheless countries like Germany and the UK which a decade ago turned their backs on nuclear power, are taking a second look.

In the short run it looks to me like we're going to be relying on the energy sources we have now for years to come. New York is blessed with a greater diversity of sources than most other states, with four nuclear plants and the largest hydroelectric capacity in the Eastern U.S. And our popular but overburdened and underfunded public transportation systems give the state an unusually low per capita energy usage. But our fossil fuel costs are above national averages, and those are also the least environmentally desirable fuels.

The biggest short term payoff appears to be in using our traditional fuels more effectively – not just efficiently, but effectively. One time investments in weatherization, building retrofits, *etc*. can save enormous amounts of energy, and these are targets of the

energy provisions in the American Recovery and Reinvestment Act of 2009. Let me pause here to say a few words about this Act and its impact on New York energy issues.

Under "Energy Programs" in the US Department of Energy, the Act identified $16.8 billion for Energy Efficiency and Renewable Energy, $4.5 billion for Electricity Delivery and Energy Reliability, $3.4 billion for Fossil Energy R&D, and $1.6 billion for Science plus $400 million for the new Advanced Research Projects Agency-Energy (ARPA-E). Also $6 billion for guaranteed loans for the Innovative Technology Loan Guarantee Program. All these funds are over and above base budget figures for DOE that already had increased in response to widespread and bipartisan recognition that 'energy is important to America.' That adds up to a very big bundle of money intended to be spent quickly on projects that address a huge array of energy-related activities. How these funds are being used is under heavy scrutiny. Special metrics and requirements for frequent reporting have been established for all ARRA projects.

New York State received $34 billion of ARRA funds overall, about $1.7 billion of which was for energy and environmental projects. My own university, Stony Brook received 110 separate ARRA grants totaling $57 million (mostly not in energy). With that came unprecedented reporting requirements – more than 400 additional reports per year for Stony Brook. New York set up a special stimulus oversight panel of its own to track expenditures and comply with reporting requirements. All these grants come packaged with red tape.

In New York, the largest energy-related ARRA programs are for weatherization assistance programs ($395 million), Smart Grid ($276 million), and science ($254 million), plus diverse programs each under $200 million, of which the largest is the Energy Efficiency and Conservation Block Grant. New York's major national energy laboratory, Brookhaven National Laboratory, captured $307 million, mostly to accelerate construction of its new billion dollar instrument for studying multi-disciplinary nano-scale phenomena, NSLSII. Some have questioned how such basic science can be regarded as a short term economic stimulus, but the Brookhaven project entails a huge amount of conventional construction which created an estimated 2,000 jobs.

Everyone knows, however, that a burst of funding like this is like trying to stop a locomotive by throwing stones at it. The momentum of our current carbon based energy technology is too big to divert in one shot even with the government's billions. We need the kind of sustained investment that only a stable, growing economy and reliable regulatory environment can generate. After the stimulus money runs out, then what? Much depends on how fast the economy recovers and whether our governments can agree on a reasonably predictable energy policy.

Despite the problems and obstacles, however, there is one important dimension of today's energy economy that holds much promise. The information technology revolution that is still unfolding has profound implications for patterns of energy use and for end use devices. Of course miniaturization and developments like solid-state lighting have a direct impact on energy consumption. But the extraordinary articulation of the

Internet and the many clever applications of it are affecting the working lives of hundreds of millions of people around the world. Where people live, what they do in their work, and how they spend their leisure time are all undergoing major changes in a social revolution unlike anything since the rise of the automobile and its physical networks of roads and fueling stations. Some version of these will remain, but how they are used will change.

Moreover, the numerous domestic and industrial machines that accompany our daily lives are morphing into smart, multitasking, integrated systems. The Economist magazine this week has a special section on smart systems that suggests the possibilities. They are built around sensors and networks and devices with embedded processors whose cost and availability are within the capabilities of even a weak economy. They can be made more efficient and more reliable, but no expensive breakthroughs are needed to incorporate them into a multitude of applications that are growing within an increasingly complex ecology of innovation. New York's stimulus-funded Smart Grid projects are examples of smart system applications, but other kinds of smart systems for home, workplaces, cars, and so on, will have their own energy impacts. If there is one big blind spot in all our energy projections, it may be the impact on energy usage by information technology.

New York is ideally poised to exploit this emerging dimension of the energy economy. Its variety of energy sources by mode and geography, its historic industries in electrical and information technology, its collection of outstanding research universities and laboratories, and not least a robust and abiding interest in energy policy by state governmental entities, all prepare us to play leadership roles in seizing the emerging power of information technology to address energy problems.

Learning about this and other opportunities is a big part of what the Advanced Energy 2010 conference is all about. Another big part is the occasion to meet the key players in the world of energy and find out how you can enhance your own prospects and those of your clients and customers in the exceptionally complex, uncertain, but dynamic world of energy. I want to thank the organizers and all of the sponsors, especially our host sponsors GE, NYSERDA, NYPA, and Stony Brook University. Thank you all for helping to make Advanced Energy 2010 a rewarding and productive experience for everyone.