

Mr. Chairman, members of the committee, I appreciate the opportunity to give my thoughts on future directions of the DOE Office of Science. I will get right to the point.

Energy is the single most important problem facing humanity today. We must find an alternative to oil.

We need to somehow provide clean, abundant, low cost energy throughout the world to the 6 billion people that live on the planet today, and the 10+ billion that are expected by the middle of this century. The cheaper, cleaner, and more universally available this new energy technology is, the better we will be able to avoid human suffering, and the major upheavals of war and terrorism.

Even though the problem of energy has vast political, economic, and social aspects that have been at the root of most wars and much of the political strife of the last century, it is only a technical problem.

There will be a technical solution.

We just need to find it.

I believe this should be the principal mission of the DOE Office of Science: to nurture and cultivate the science base out of which this new energy technology will come.

And I believe it is time to get very serious about this mission: give them the resources they need, and help them make it happen.

The new energy technology must not involve burning carbon. When all costs are figured in, fossil energy is too expensive now, and can only become more expensive in the future as resources are depleted and billions of people in developing countries begin to live modern lifestyles. The consequences of burning all this

carbon and discharging vast amounts of carbon dioxide in the atmosphere are now becoming clear. We must find another way.

It can only be nuclear. With our current understanding of physics, only nuclear fission or fusion can produce energy in the vast amounts we will need.

Fission is our only developed alternative to fossil fuels as the world's primary energy source, but it has well-known problems that are fundamental. It unavoidably creates radioactive wastes that must be sequestered for thousands of years, and creates risk of proliferation of nuclear weapons.

Fusion – practical controlled thermonuclear fusion reactors – are still many, many decades away, and even then will have problems of radioactive waste due to neutron bombardment of the confinement vessels.

If the answer has to be nuclear, it would be best to be far, far away from the reactor. Nature has already given us one such reactor, and provided the necessary distance and shielding. It is our Sun.

There is plenty of energy from this natural fusion reactor to provide all our energy needs for centuries to come. We just don't know how to harvest it, store it, transport it, and use it in the amounts we need.

I believe DOE Office of Science can find the answers to how to do this.

The technology that will do what we need does not yet exist. It will come from discoveries in basic science, and particularly from nanotechnology. The biggest breakthrough will come in some perhaps small lab, in some surprising way – perhaps made by some brilliant young black woman who is currently not even out of high

school. It will come from the garden of science, cultivated by DOE's Office of Science.

Currently the Office of Science plays a unique and critical role in the multi-agency National Nanotechnology Initiative. In addition to funding research in the university community, the Office of Science is also establishing Nanoscale Science Research Centers. These are user centers just like the synchrotron light sources and neutron scattering facilities operated by the Office of Science. The Nanotech centers will provide unique scientific and engineering capabilities not available in any of the parallel programs sponsored by other government agencies. For example, the NSF sponsors research programs in nanotechnology at universities, but such programs are modest in size and will not be comparable to the large-scale facilities in Europe or Japan.

Incidentally, Japan's budget for nanotechnology this year is \$650 million, exceeding the US expenditure of \$604 million. The Japanese government plans to ramp up funding of nanotechnology research to a level of \$2 billion per year by 2005. Korea and China are also investing heavily, as is western Europe. Funding for nanotechnology research in the US is currently less than 1/3rd of the funding worldwide. This is not a good sign.

The current budget request for the Office of Science contains a modest and reasonable increase to sustain its critical mission this next year. I support it, and realize that in the current financial times it is probably the most that one can hope for. But I believe it is far too little, and far disproportionate to the magnitude of the problem. We need to find that new energy technology, and do it quickly.

I believe the US should launch a 1B\$/yr program within the Office of Science to find this answer, and plan to ramp this up to

over \$10B in 5 years. The new energy program must be big enough to inspire and capture the imagination of our nation's youth, get them to choose a career in science because of their idealism, and their sense of mission. And the program must be bold enough to actually make the necessary scientific breakthroughs happen.

If we do this, it will help the image of the US in the minds of the world's population. It will give us energy security, and will help to diffuse political stress and reduce the threat of terrorism both here and throughout the world.

With your help we can make clean, abundant, low cost energy be this nation's best gift to humankind.