ENERGY AND WATER DEVELOPMENT APPROPRIATIONS FOR FISCAL YEAR 2005

WEDNESDAY, MARCH 3, 2004

U.S. SENATE,
SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS,
Washington, DC.

The subcommittee met at 10:08 a.m., in room SD–138, Dirksen Senate Office Building, Hon. Pete V. Domenici (chairman) presiding.

Present: Senators Domenici, Craig, Reid, and Murray.

DEPARTMENT OF ENERGY

OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

STATEMENT OF DAVID GARMAN, ASSISTANT SECRETARY

OPENING STATEMENT OF SENATOR PETE V. DOMENICI

Senator DOMENICI. The committee will come to order. Thank you everyone for coming. It's interesting to note that, of no consequence other than it's interesting, this is the first meeting of the Subcommittee on Energy and Water and we haven't yet seen impact that the budget's going to have on this subcommittee's ability to do its work, but it's pretty obvious that it won't be a bed of roses, so I regret to tell you that I don't think there's any chance that very many of the discretionary programs are going to be funded with any increases. Most will get some cuts.

But today we're going to review the Department of Energy's 2005 budget request, the Office of Energy Efficiency and Renewable Energy, the Office of Science, and the Office of Nuclear Energy, and we will receive testimony from David Garman, Assistant Secretary, Office of Energy Efficiency. I'd like to thank you for joining us. And Dr. Raymond Orbach, Director of the Office of Science, and William Magwood, Director of the Office of Nuclear Energy. I appreciate your attendance today and look forward to your testimony.

The budget request for Renewable Energy provides $374 million, an increase of $4.3 million. DOE—that's 1.2 percent—DOE's budget provides $95 million for hydrogen technology, that is the basic research. It's a $13 million increase and overall the President proposes spending $228 million on hydrogen R&D, multi-agency effort to diversify energy supply.

Office of Science, the administration requests $3.4 billion, a reduction of $78 million, 2 percent below last year's level. Science re-

ports specifically stated that flat funding for the office should be reversed. Unfortunately, that language was ignored.

Dr. Orbach, I understand the Secretary of Energy released a 20-year science plan late last year which will serve as a road map for science research. I appreciate your efforts to focus on these priorities and look forward to learning more about this proposal.

For the Office of Nuclear Energy, the budget provides $409 million, that's a $4.7 million increase, 1.2 percent. I'm disappointed to learn that nuclear R&D budget has been cut by $34 million, a 26 percent reduction. If I have anything to do about it, I'll put that money back, but I don't know how to do it yet.

The budget also cuts nuclear energy technology by 50 percent. I'm skeptical that the Department is serious about its commitment to deploy a new nuclear reactor, especially if you put a date alongside it of 2010.

I'm discouraged by the fact that the advanced fuel concepts initiative was cut. The objective of this program is to develop a proliferation-resistant nuclear fuel. In light of the recent news regarding the sale of nuclear materials, the last and biggest being Pakistan's top nuclear scientist, I believe more should be done to protect against nuclear proliferation, not less. I think we're beginning to make people understand that in the administration. The President spoke to it, Secretary Powell has alluded to it, but nonetheless you can't do this without money, and I'm hopeful that America will take the international lead in this regard.

PREPARED STATEMENT

I'm now going to turn to my good friend who's been working with me on this subcommittee either as chairman or ranking member for many years, Senator Reid. I'd like you to make your opening statement and then we will proceed in order to Mr. Garman, Dr. Orbach, and Mr. Magwood.

[The statement follows:]

PREPARED STATEMENT OF SENATOR PETE V. DOMENICI

Today, the subcommittee will review the Department of Energy's fiscal year 2005 budget request for the Office of Energy Efficiency and Renewable Energy, the Office of Science, and the Office of Nuclear Energy.

We will receive testimony from David Garman, Assistant Secretary, Office of Energy Efficiency and Renewable Energy, Dr. Raymond Orbach, Director, Office of Science, and William Magwood, Director, Office of Nuclear Energy.

I appreciate your attendance today and look forward to your testimony.

The budget request for Renewable Energy provides $374 million—an increase of just $4.3 million (+1.2 percent). The DOE budget provides $95 million for hydrogen technology research, a $13 million increase. Overall, the President proposes spending $228 million in fiscal year 2005 on hydrogen R&D in a multi-agency effort to diversify our Nation's energy supply.

For the Office of Science, the administration has requested $3.4 billion—a reduction of $78 million or 2 percent below last year's level. The Senate report specifically stated that flat funding for the Office of Science should be reversed—unfortunately, that language was ignored.

Dr. Orbach, I understand the Secretary of Energy released the 20-year Science Plan late last year, which will serve as a road map for DOE's science research. I appreciate your efforts to focus the Department's priorities and I look forward to learning more about this proposal.

For the Office of Nuclear Energy, the budget provides $409 million—an increase of $4.7 million above fiscal year 2004 (+1.2 percent).

I am disappointed to learn that the Nuclear R&D budget has been cut by $34 million (−26 percent). The budget entirely eliminates funding for the Nuclear Energy Plant Optimization and the Nuclear Energy Research Initiative.

This budget also cuts the Nuclear Energy Technologies by 50 percent. As a result of these cuts, I am skeptical that the Department is serious about its commitment to deploy a new nuclear reactor by 2010.

I am also discouraged by the fact that the Advanced Fuel Concepts Initiative was cut by 30 percent. The objective of this program is to develop a proliferation-resistant nuclear fuel. In light of the recent news regarding the sale of nuclear material by Pakistan's top nuclear scientist; I believe more should be done to protect against nuclear proliferation.

It is clear from these lean budgets that we will face numerous challenges this year. Nevertheless, I look forward to working with Senator Reid to develop the best bill we can.

I will now turn to Senator Reid or any other Senator who would like to make a brief opening statement. Thereafter, we will hear from Mr. Garman, Dr. Orbach, and Mr. Magwood.

STATEMENT OF SENATOR HARRY REID

Senator REID. Thank you very much, Mr. Chairman. You and I have worked together, a long, long time together on this committee, subcommittee, I'm sorry, and I enjoy working on this bill with you. I think the enjoyment will have been better in the past than this year because of the tremendous constraints on the budget. It's been frankly a lot of fun in years past, but I don't see that happening this year, but with our friendship we'll work our way through this.

Today is a first, as you have indicated, in a series of five budget oversight hearings for our subcommittee. Next week, a week from today, the subcommittee will hear testimony from the Bureau of Reclamation and the Corps of Engineers, which is so vitally important to the entire western half of the United States.

Today we're going to hear from the witnesses as you've outlined. I've reviewed all your statements and they cover some of my most—some of my favorite subjects, alternative energy and all these things that are so important to the future of our country.

I'm going to—we have a big tax bill coming up in 20 minutes so I have to leave soon, go back and work on that on the floor, but I appreciate everyone being here. I have a series of questions for each of the witnesses, Mr. Chairman, and I would ask consent of the subcommittee that I be allowed to submit those in writing and that they respond to them within the next 10 days in writing.

Senator DOMENICI. Yes, sir.

Senator REID. And the answers go to every member of the subcommittee.

Senator DOMENICI. I'll submit them on your behalf and let me say to you, if you have any trouble with the time, I don't expect you to just let it pass. I expect you to tell us why, if you had to go find something or whatever then let us know. Go ahead, Senator.

OFFICE OF SCIENCE FISCAL YEAR 2005 BUDGET REQUEST

Senator REID. I've reviewed the budget for the Office of Science, and by and large I suspect that you share some of the same frustrations as I have and you won't articulate them today and I understand why you can't. I'm concerned that such a budget, if enacted, will not allow you to move forward aggressively on enough major initiatives, including the ITER Project.

The request also strikes me as inadequate in terms of allowing you to maintain and improve your laboratory facilities nationwide. My overall impression is that the request is weak and I really believe it's short-sighted. I hope we'll be able to improve on that this year before we complete our work.

As I've said many times before, funding for research in the hard sciences is one of the very best and most appropriate investments taxpayer dollars can be made for this country. Few things that we do here can make our country safer or more secure than maintaining a scientific and technological edge.

For many years now, Chairman Domenici and I have watched as the last two administrations have sent ever-escalating budget requests up here for National Institutes of Health that have far outstripped the increase requests of the Office of Science. The imbalance between funding for the physical sciences and the biological sciences was getting to be staggering, particularly because both disciplines rely on each other so much. I think this is short-sighted in the long term.

I'm pleased with the work that you're doing on genomics and with the very impressive pace of the nanotechnology. Drew Willison of my staff and Tammy Perrin of Senator Domenici's staff visited the Lawrence Berkeley National Lab last month and were surprised at the rapid progress the lab is making on the molecular foundry.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

You've been on the job now for nearly 2 years and I hope you're enjoying your time in one of the greatest jobs our Federal Government has to offer. Mr. Garman, as you know, I am a big supporter of your programs and believe that the National Renewable Energy Laboratory in Golden is one of the premiere labs in all the DOE if not the world. While I certainly hope we can add some resources to your budget, I realize that the most important thing Congress can do in the short term for the renewable energy industry is to get a series of productive tax credits into place and extend some of the others. Hopefully our body will be able to get that done this year and we may be able to get it done on this bill this week.

For the last few years, you've funded a competitive project in Nevada that has worked very well. As you know, my State has tremendous solar and geothermal potential and the seed money for the Department—that the Department has provided—allows Nevada and its universities and research organization industries to work together to prove out technology and techniques.

NUCLEAR ENERGY

Mr. Magwood, as you know, I've been very supportive of your programs during my years as chairman and ranking member of this subcommittee. I'm supportive even though it sometimes puts me in an awkward spot due to that very visible word, nuclear in your office's title. I support strong budgets for you because, as I mentioned earlier, long-term stable investments in scientific research and development is what makes our Nation strong.

My biggest problem with nuclear power comes, of course, at the end of the fuel cycle, and we've heard that so many times that I

even get tired of myself saying it. To the extent that there will be an ongoing waste stream, it will be investments in science that solves all or most of those disposal problems, and you're involved in that and I appreciate that.

That's why I've supported your advanced fuel cycle initiative over the years. I'm a little concerned this year that your support for this program seems to have eroded, but I suspect that Chairman Domenici and I can help you un-erode it as we move through this budget.

PREPARED STATEMENT

I feel confident that Senator Craig and Domenici have thoughts on the ongoing transition of the laboratory in Idaho to the Nation—this is to the Nation's nuclear energy laboratory, so I'll not address that issue at this time, other than to say that I'm far more interested in an aggressive R&D budget that benefits the Nation as a whole than I am in a long, slow, drawn-out transition.

I thank everyone for appearing today and appreciate the patience of everyone listening to my long statement.

[The statement follows:]

PREPARED STATEMENT OF SENATOR HARRY REID

Thank you, Mr. Chairman. By my count you and I are beginning our eighth Energy and Water appropriations cycle together. As you know I enjoy working on this bill with you and greatly appreciate your friendship and support throughout our many years together here in the Senate.

Today is the first in a series of five budget oversight hearings for our subcommittee. Next Wednesday, the subcommittee will hear testimony from the Bureau of Reclamation and the U.S. Army Corps of Engineers.

Today we will hear from three witnesses: Dr. Raymond Orbach, the Director of DOE's Office of Science; Mr. Bill Magwood, the Director of the Office of Nuclear Energy; and Mr. Dave Garman, the Assistant Secretary for the Office of Energy Efficiency and Renewable Energy.

Good afternoon, gentlemen, thank you for coming. Senator Domenici and I both appreciate you taking the time to join us. My duties on the Floor may require me to depart early today, but my staff will remain here and will report back on what transpires. I do have a series of questions for each of you and would ask, at this time, that they be made a part of the record. I hope each of you can respond quickly because the Chairman and I rely on your answers to help us make informed funding decisions. We are likely to be on an accelerated schedule this year so timely responses are critical.

I plan to keep my comments very brief today, but do want to highlight several issues concerning the budget requests for each of the three DOE offices represented today.

Dr. Orbach, I have reviewed the budget for the Office of Science and, by and large, I suspect that you and I share some of the same frustrations with it. The administration's budget request provides your office with a 2 percent cut this year. I am concerned that such a budget, if enacted, will not allow you to move forward aggressively enough on a number of major initiatives, including the ITER project. The request also strikes me as inadequate in terms of allowing you to maintain and improve your laboratory facilities nationwide.

My overall impression is that the request is weak and shortsighted.

I hope that we are able to improve on that a little bit before Congress completes work this year. As I have said many times before, funding for research in the hard sciences is one of the very best and most appropriate investments of taxpayer dollars that Congress can make. Very few things that we do here can make our country safer or more secure than maintaining a scientific and technological edge.

For many years now Chairman Domenici and I have watched as the last two administrations have sent ever-escalating budget requests up here for the National Institutes of Health that have far outstripped the increases requested for the Office of Science. The imbalance between funding for the physical science and the biologi-

cal sciences was getting to be staggering, particularly because both disciplines rely on each other so much.

Again, over the long-term, this is very short-sighted.

That said, I am very pleased with the work you are doing on genomics and with the very impressive pace of the nanotechnology program. Drew Willison of my staff and Tammy Perrin of Senator Domenici's staff visited Lawrence-Berkeley National Laboratory last month and were surprised at the rapid progress the lab is making on the Molecular Foundry.

You have been on the job now for nearly 2 years and I hope you are enjoying your time in one of the greatest jobs our Federal Government has to offer.

Mr. Garman, as you know, I am a big supporter of your programs and believe that the National Renewable Energy Laboratory in Golden is one of the premiere labs in all of DOE. While I certainly hope we can add some resources to your budget this year, I also realize that the most important thing Congress can do in the short term for the nascent renewable energy industry is to get a series of production tax credits into place and to extend some of the others. Hopefully, we, as a body, will be able to get that done this year.

For the last few years you have funded a competitive pilot project in Nevada that has worked tremendously well. As you know, my home State has tremendous solar and geothermal potential and the seed money the Department has provided has allowed Nevada universities, research organizations, and industries to work together to prove out technologies and techniques. I appreciate your hard work and that of your staff in getting this program started and keeping it moving forward.

Mr. Magwood, as you know I have been very supportive of your programs during my years as Chairman and Ranking Member of this subcommittee. I am supportive even though it sometimes puts me in an awkward spot due to that very visible word "nuclear" in your office's title.

I support strong budgets for you because, as I mentioned earlier, long-term, stable, investments in scientific research and development is what makes our Nation strong.

My biggest problem with nuclear power comes at the end of the fuel cycle. However, I firmly believe that investments in the future of nuclear power can produce reactors that are safer and will not produce the deadly waste streams that plague the current generation of reactors.

To the extent that there will be an on-going waste stream, it will be investments in the science that solves all or most of the disposal problem.

This is why I have supported your Advanced Fuel Cycle Initiative over the years. I am a little concerned this year that your support for this program seems to have eroded, but I suspect that Chairman Domenici and I can help you in this area.

I feel confident that both Senator Craig and Senator Domenici have many thoughts on the on-going transition of INEEL to the Nation's nuclear energy laboratory, so I will not address that issue at this time other than to say that I am far more interested in an aggressive R&D budget that benefits the Nation as a whole than I am in a long, slow, drawn-out transition.

Again, thanks to our witnesses for appearing today.

Senator DOMENICI. Senator, thank you very much, and now we will excuse you and look forward to the next hearing.

Senator, would you like to make some comments, please?

Senator MURRAY. Mr. Chairman, I do not have an opening statement. I'll just welcome the witnesses. I do have questions and we'll wait until after they've had their testimony.

PREPARED STATEMENT OF SENATOR THAD COCHRAN

Senator DOMENICI. Senator Cochran has submitted a statement for the record which will be included.

[The statement follows:]

PREPARED STATEMENT OF SENATOR THAD COCHRAN

Mr. Chairman, I'd like to thank the Assistant Secretary and Directors for testifying before this committee today. The work you do is very important to my State and to me. I commend David Garman, the Assistant Secretary of the Office of Energy Efficiency and Renewable Energy, for the work his department does with biomass research.

Biomass energy is estimated to contribute over 7 percent of Mississippi's total energy consumption—that amount is double the national average. The majority of our lumber facilities burn wood waste to generate steam for industrial processes. Biomass offers special benefits for Mississippi's economy by keeping energy dollars in our State and by providing jobs in rural areas where biomass is produced. By using these wastes for energy, disposal costs are avoided, and industries are better able to compete. I would also like to commend Mississippi State University and Jackson State University for their continuing research into this important scientific area.

Mr. Chairman, with your permission I have some questions I'd like to submit for the record.

Senator DOMENICI. Let me say how good it has been to have you working with us on this subcommittee. You have some very significant interests, but I'm very pleased to find that when we have problems on this committee, you're there to help us. It's not just strictly what's going on in your State, and we all need each other. Some very tough, tough problems when you cut the budget as much as ours here.

I want to make one last observation before I proceed to the witnesses. I don't know how to solve it, but I want to say about 10 years ago or a little less, a couple of Senators circulated around and got most of us to sign up on a resolution. Perhaps you signed it like I did and you probably, having been here awhile, chuckled as you signed it. We were going to make the NIH, National Institute of Health, double in 10 years. Of course, we signed it as we walked out the door wondering, who's kidding who?

Well, it happened, and every year after that it would be among the last bills, and sure enough, somebody would stand up and say, well, in order to meet our resolution we need $680 million more and the next year they needed a billion and here we have the largest National Institute of Health growth in a decade of any institution of that type in the world has ever seen. And here we sit with everybody telling us the counterpart is science, right, that without basic science, pretty soon the NIH, with all of its work, is going to be without the talent that's needed to back up the medical people.

And here we come, not critical of the President, after all we're in this terrific deficit, but here we are. While that occurred, we're cutting basic science, not increasing it. And I'm just wondering what we have to do around here to get us on a path where we recognize that these scientists and scientific prowess is not going to keep America if we don't fund it.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

And so with that, I'm very sorry to start with such a negative comment, but let me open with you, Mr. Garman. You're the Assistant Secretary of Energy Efficiency and Renewable Energy and we want you to give your testimony and be ready for questions. I do want to say to you, sir, from the first time I inquired of you about this work, you have come a long way and I am very complimentary of you.

First of all, you are not run by the renewable associations out here in America. They have their interests but they don't run your Department. You're not supposed to be running their editorials, you're not supposed to be paying for their journals. Remember, we had all that going when you took over. Of course, all they did was get mad. Then when you looked at it you found that Domenici was

right, that if you want to do research, you ought to do research, but you sure shouldn't be paying for various organizations to get done what they want. They aren't synonymous with research. And now I think it's pretty clean in that regard.

I also want to tell you that we can do as much research as you want, but ultimately Americans want to see some of this work, and I am very, very pleased that I heard today that Democratic leader said we have the votes to pass the Energy bill. Now why would I be speaking of that at the same time? Well, you know, if you want to build wind energy, you want to build solar energy and biomass energy, everybody knows how to do that. You can perfect it, but that's already passed, your research issues.

And we're ready to go and build those but we need the incentive that caused them to move ahead so rapidly, and what everybody's finding out now, there is no incentive today. And people say, well what do you mean? Well, the incentives expired in January, so those who are very anxious and terribly enamored as most of us are with energy that comes from wind, you ought to know that unless you have a project that is already going, there are no new ones, and there's nobody going to do a new one. Why? Because they can't afford it.

But if we pass this bill they got this wonderful incentive for this next decade, and you will see biomass and geothermal and these other ones, you'll see them flourish across the land. The biggest one will be wind. Whether the public's going to want that much wind, I don't know. It's going to look funny because there's going to be a lot of it, but I think we're going to win, I think it's going to happen.

All right, would you proceed with your testimony? Make it brief, please.

STATEMENT OF DAVID GARMAN

Mr. GARMAN. Yes, sir. And thank you for your comments. As you noted in your statement, we are seeking an increase of $17.3 million in the renewable energy funding, and a budget increase in this environment does constitute an awesome responsibility and we understand that. We're not only mindful of how much we spend, but the way we spend it, as you noted, and we're proud of the fact that OMB has recognized the Department of Energy as leading the pack of Cabinet agencies in terms of management improvement, and we're also proud that the Office of Management and Budget has singled out the Office of Energy Efficiency and Renewable Energy as an example in implementing the President's management agenda.

So I will very briefly mention a few highlights of our budget. Our hydrogen technology subprogram is a key component of the President's Hydrogen Fuel Initiative. For 2005, we request $95.3 million, a $13.3 million increase. With these funds we propose to continue and accelerate our work with regard to hydrogen production, safety, storage, codes and standards, and other work that's critical to the long-term success of this initiative.

Last year, roughly $40 million out of our total hydrogen appropriation of $82 million was earmarked for some specific projects that in many cases were inconsistent with our research plan, so we

will have to delay some very important work in areas such as hydrogen storage and production that the National Academy of Sciences and others have told us is very important to the success of our program.

For our solar energy technology program, we're seeking $80.3 million, roughly equivalent to the unencumbered amount of our fiscal year 2004 appropriations. With this funding, we'll continue our work to lower the cost of photovoltaic solar energy systems, and for the first time in several years we're seeking funding for concentrating solar power technologies.

Our wind energy technology program has been successful in bringing down the cost of electricity generated from wind. Wind energy systems have been the fastest growing source of electricity worldwide for over a decade, but, of course, as the chairman mentioned, that is dependent on the production tax credit, which we do hope Congress will extend very quickly.

We are starting to devote more attention to the promise of offshore wind and our focus on wind energy has shifted to larger blades and turbines using advanced materials that will allow economically viable wind development in lower wind speed areas that are distributed across the country.

For our hydropower technology work, we request $6 million, a $1.1 million increase over the fiscal year 2004 appropriation. Geothermal, as the chairman mentioned, offers a promise as a baseload renewable energy resource, particularly in the U.S. West. Our program focuses on exploration and reservoir technologies and drilling research to enable industry to locate and produce new geothermal fields at greatly reduced cost.

Our biomass and biorefinery system R&D program is focused on technologies to transform our domestic biomass resources into high value chemicals, fuels, and power. In fiscal year 2005, we're seeking $72.6 million for activities conducted under this appropriation. That's $13.9 million less than the fiscal year 2004 amount. However, last year we did receive nearly $41 million in earmarks, so we're actually seeking far more funding directed toward our biomass and biorefinery R&D goals than we received last year.

PREPARED STATEMENT

There are a variety of other programs and activities that time doesn't allow me to mention, but for now I ask that my full statement appear in the record and I'm happy to answer any questions this committee has either today or in the future. Thank you, Mr. Chairman.

[The statement follows:]

PREPARED STATEMENT OF DAVID GARMAN

Mr. Chairman, Members of the subcommittee, I appreciate the opportunity to testify on the Fiscal Year 2005 President's Budget request for the Office of Energy Efficiency and Renewable Energy (EERE). My focus will be the renewable energy activities under the purview of this subcommittee.

The research and development activities surrounding and the deployment of advanced clean energy technologies are already making a difference in the lives of Americans, and they will have an even greater impact in the future. The overall EERE budget request for fiscal year 2005 is a robust $1.25 billion, an increase of $15.3 million over the comparable fiscal year 2004 appropriation. For the renewable energy programs funded through the Energy and Water Development appropriation,

the fiscal year 2005 request totals $374.8 million, a $17.3 million increase over the fiscal year 2004 appropriation and 30 percent of the total EERE Budget.[1]

We are not only mindful of how much we spend on these programs, but also the manner in which we operate and the results we are achieving. Our budget is prioritized in accordance with the National Energy Policy Report and the Department of Energy Strategic Plan. EERE has also used the research and development investment criteria called for in the President's Management Agenda to focus our research and development dollars on a balanced portfolio of well-planned activities that could generate significant public benefits and that require Federal involvement to be successful.

The Office of Management and Budget (OMB) recently announced that DOE has made the most progress among cabinet-level agencies in the implementation of the President's Management Agenda. OMB recognized the Department as the cabinet-level agency "leading the pack with regard to management improvement." In support of that, EERE in 2002 underwent a dramatic restructuring to streamline program management and centralize administration functions with a focus on developing consistent, uniform and efficient business practices. We are also increasingly successful in linking our expenditures with performance and results. We are striving to achieve more work in the laboratory with every research and development dollar entrusted to our stewardship. While we are very proud of the accomplishments we have made, a great deal of progress remains to be made in all of these areas.

RENEWABLE ENERGY PROGRAMS FISCAL YEAR 2005 BUDGET REQUEST

The renewable energy programs included in the Energy Supply account and funded within the Energy and Water Development appropriations include Hydrogen Technology, Solar Energy Technology, Wind and Hydropower Technologies, and Geothermal Technology. Activities in the Biomass Program and Intergovernmental programs are funded through both the Energy and Water Development and Interior and Related Agencies appropriations.

HYDROGEN TECHNOLOGY

The Fiscal Year 2005 Budget Request for Hydrogen Technology is $95.3 million, a $13.3 million increase over the fiscal year 2004 appropriation. Much of the proposed increase is for hydrogen safety research. This includes safety testing and analysis on bulk storage systems, fuel dispensing equipment, and piping to support new codes and standards specific to hydrogen. The Department has worked with the Department of Transportation and other agencies on an interagency codes and standards plan. Under this activity, we will also develop system safety requirements for producing hydrogen and sensors to detect hydrogen leaks.

Research undertaken in the Hydrogen Technology Program is also targeted to reduce the cost of distributed hydrogen production from electrolysis and natural gas reformation. An enhanced focus on electrolysis, as recommended by the National Research Council, may lead to cost competitive production of hydrogen from renewable energy at $2.25 per gallon of gasoline equivalent by 2015.

One of the major technical obstacles we face is developing the means to store sufficient amounts of hydrogen aboard the vehicle to provide a driving range of greater than 300 miles. The fiscal year 2005 budget provides funding for innovative storage technologies to be pursued under our "Grand Challenge" to leading universities and national laboratories. "Grand Challenge" is our name for a competitive solicitation that was directed towards the scientific community to get the best minds at our universities and national labs to propose research ideas to tackle this challenging problem.

The Hydrogen program is also stepping up its efforts on education at all levels, so Americans know what the hydrogen economy will mean for them, their businesses, and the environment, and understand how to handle hydrogen safely in their communities.

Our hydrogen work is well integrated with the fuel cell and vehicle work funded through the Interior Appropriations bill. Taken together, these programs represent the majority of the Federal efforts comprising the Hydrogen Fuel Initiative announced by President Bush during his 2003 State of the Union Address, and we have published very specific, measurable technical goals against which to measure our progress. If we achieve our technical objectives, the automotive and energy industries will be in a position to consider commercialization by 2015, with mass market availability of both vehicles and refueling infrastructure by 2020.

[1] Activities focused on energy conservation are funded through the Interior and Related Agencies appropriations bill.

The President's initiative was received by Congress with enthusiasm, and we appreciate this subcommittee's support. However, while the fiscal year 2004 EERE appropriation for hydrogen technology was approximately $82 million, roughly half of those funds were earmarked for specific projects that are not wholly consistent with our research plan or the recommendations of the National Research Council. As a consequence, we must delay some very important work in areas such as hydrogen storage and production, and thus our ability to meet our established research targets in the specified timeframes may be in jeopardy. The Department looks forward to working with the subcommittee to help ensure that projects supported by the Committee are consistent with our established goals in an effort to keep our progress on track.

SOLAR ENERGY TECHNOLOGY

The Solar Energy Technology program focuses research on advanced solar devices that can provide the Nation with a widely available domestic energy resource to help meet electricity needs and reduce the stress on our critical electricity infrastructure. Efforts are directed in the interrelated areas of Photovoltaics, Solar Heating and Lighting, and Concentrating Solar Power. The fiscal year 2005 budget request for Solar Technology is $80.3 million. This is roughly equivalent to the unencumbered amount of the fiscal year 2004 appropriation of $83.4 million, which included $3.6 million earmarked to specific recipients.

Photovoltaic research and development seeks to reduce the manufacturing cost of highly reliable photovoltaic modules from $2.10/watt in 2003 to $1.85/watt by fiscal year 2005. The program is focused on next-generation technologies such as thin-film photovoltaic cells and leap-frog technologies such as polymers and nanostructures. Systems engineering efforts seek to increase system durability and develop technologies to improve interconnections with the electric grid. The fiscal year 2005 request of $75.4 million for photovoltaic includes: $30 million for critical fundamental research, including $2.1 million to equip the new Science and Technology Facility at the National Renewable Energy Laboratory; $29 million for advanced materials, including thin films and next generation materials with potential for dramatic cost reductions; and $16.4 million for technology development efforts to improve reliability of the entire system, including testing, verification, and deployment activities for grid-connected applications and analysis of private sector commercialization options.

The fiscal year 2005 $2.9 million request for Solar Heating and Lighting will support efforts on hot water and space heating for residential and commercial buildings in collaboration with industry partners. The program uses new formulations of lightweight polymer materials to modernize solar water heaters, making them easier to install, while lowering the cost of solar water heating in non-freezing climates.

Last year, we did not request any funding for the Concentrating Solar Power (CSP). In light of recent studies we sought from an independent engineering firm, a draft of which was reviewed by the National Research Council, the Department proposes $2 million for Concentrating Solar Power in fiscal year 2005 to support a more thorough investigation of the appropriate R&D course needed to realize the potential for CSP. The fiscal year 2005 budget request will maintain essential facilities and support work with several States on the establishment of 1,000 MW of Concentrating Solar Power in the Southwest, while developing a comprehensive program plan to help inform the fiscal year 2006 budget development process and a longer term R&D plan.

ZERO ENERGY BUILDINGS

Zero Energy Buildings activities develop strategies to integrate renewable energy technologies into highly energy-efficient buildings that produce as much or nearly as much energy as they consume on an annual basis. The fiscal year 2005 budget request for the Building Technologies Program funded through the Interior Appropriations bill combines this energy research and development with ongoing activities in the Buildings program and therefore, no fiscal year 2005 funds are requested in this area.

WIND AND HYDROPOWER TECHNOLOGIES

Wind and Hydropower research and development supports the Nation's fastest growing and most widely used renewable energy resources. These technologies emit no air pollution or greenhouse gases, and they produce significant amounts of bulk power to help meet America's growing need for clean, domestic sources of electricity.

Since 2000, installed wind turbine capacity in the United States has more than doubled, driven in large part by the tremendous reductions in cost that have re-

sulted from wind energy research. Our research contributed to reducing the cost of electricity generation by a factor of 20 since 1982, to 4 cents or less per kilowatt-hour in areas with excellent wind resources.

The fiscal year 2005 budget request for Wind Energy is $41.6 million, $290,000 more than the fiscal year 2004 appropriation, which included $1.4 million in funds that were earmarked to specific recipients. The $12 million request for Low Wind Speed Technology research and development will support multiple large wind system technology pathways to achieve the goal of 3 cents per kilowatt-hour for onshore systems. It also supports new work in off-shore systems to help achieve a cost goal of 5 cents or less per kilowatt-hour. Fiscal year 2005 activities will include field testing of the first full-scale low wind speed technology prototype turbine and fabrication and testing of advanced drivetrains, power converter and blades for future low wind speed turbines. The $17 million request for supporting research and testing will engage the capabilities of the National Labs, universities and private sector for technical support including both facility and field tests of newly developed components and systems to ensure design and performance compliance.

Hydropower is the most widely used form of renewable energy in the world today and accounts for about 7 percent of total electricity generation in the United States and over 75 percent of domestic renewable electricity generation. The fiscal year 2005 budget request for Hydropower Technologies is $6.0 million, a $1.1 million or 22 percent increase over the fiscal year 2004 appropriation. The Department's research approach involves a unique combination of computer modeling, instrumentation, lab testing, and field-testing that is improving the design and operation of the next generation of hydropower technology. The request will support development of technologies that will enable hydropower operators at existing plants to generate more electricity with less environmental impact. This will be done through environmentally enhanced, improved efficiency turbines, as well as with new methods for optimizing unit, plant, and reservoir systems to increase energy production per unit water. Supporting research and testing will improve understanding of fish response to the physical stresses experienced in passage through turbine systems. The program will also explore ways to harness undeveloped hydropower capacity without constructing new dams.

GEOTHERMAL TECHNOLOGY

The fiscal year 2005 budget request for Geothermal Technologies is $25.8 million, a $300,000 increase from the fiscal year 2004 appropriation of $25.5 million, which included almost $2 million in funds that were earmarked to specific recipients. Geothermal energy generates electricity and provides heat for applications such as aquaculture, crop drying, and district heating, and for use in heat pumps to heat and cool buildings. The program focuses on developing technology that optimizes the use of geothermal energy through improved exploration, drilling, reservoir engineering, and energy conversion. These technology improvements lead to cost-effective energy production at new geothermal fields and expanded production at existing fields.

Fiscal year 2005 resource development activities will characterize and assess the geothermal resource by understanding the formation and evolution of geothermal systems, including a collaborative effort with the U.S. Geological Survey on a national geothermal resource assessment. Activities in the Enhanced Geothermal Systems program seek to increase the productivity and lifetime of reservoirs, potentially more than doubling the amount of viable geothermal resources in the West. Fiscal year 2005 activities will include Enhanced Geothermal System field tests in California and Nevada, and tests of the Diagnostics-While-Drilling advanced drilling system in a high temperature geothermal well. New geothermal State working groups in Alaska and California will be added, bringing the number of groups to nine.

BIOMASS AND BIOREFINERY SYSTEMS R&D

Biomass and Biorefinery Systems R&D focuses on advanced technologies to transform the Nation's domestic biomass resources into high value chemicals, fuels, and power. With the U.S. Department of Agriculture, the DOE biomass program leads the multi-agency Biomass Research and Development Initiative that coordinates and accelerates all Federal bioenergy research and development in accordance with the Biomass Research and Development Act of 2000.

The 2002 EERE reorganization integrated several bioenergy activities into one office to allow a clear and consistent set of goals and objectives and increased collaboration with industry. The program worked closely with industry to produce a vision and R&D roadmap that focuses on the most promising long-term opportunities that, with leveraged funding from industry, can realize a goal of establishing the first

large-scale biorefinery based on agricultural residues by 2010. A multiyear technical plan in support of this goal provides a comprehensive work breakdown structure with milestones, costs and schedule, so that every project is linked to program goals, objectives and technical barriers.

In fiscal year 2005, the Department is requesting $72.6 million for biomass program activities in the purview of the Energy and Water appropriation, $13.9 million less than the fiscal year 2004 appropriation. However, it is important to note that the fiscal year 2004 appropriation included nearly $41 million, or nearly half of the biomass budget, targeted to specific projects not identified in program plans. Congressional earmarking has delayed progress toward the program goals and diminished core research capabilities at the National Laboratories.

Biomass activities funded through the Energy and Water appropriation focus on advanced biorefinery technologies to produce low cost sugars, syngas and pyrolysis oils. In fiscal year 2005, the thermochemical program will test the continuous production, cleanup and conditioning of biomass syngas and pyrolysis oils suitable for conversion to fuels, chemicals or hydrogen, and examine the production of hydrogen from biomass via synthesis gas. Work will continue with industry on improved process integration capabilities for industrial biorefineries, and the program will evaluate existing partnerships for more productive and lower-cost cellulase enzyme systems. Additional partnerships may further improve the procession operations leading to cheaper biomass-based sugars. Projects to test and evaluate the performance and costs of converting corn fiber to fuels and co-products will also continue.

INTERGOVERNMENTAL ACTIVITIES

Intergovernmental Activities funded through the Energy and Water appropriation include a variety of programs to promote renewable energy technologies. The fiscal year 2005 request for these programs is $16 million, an increase of $1.3 million over the fiscal year 2004 appropriation.

The International Renewable Energy Program provides technical assistance to support sustainable development and emerging market economies. These efforts expand the market of U.S. industries and reduce the cost of energy to trading partners while improving their environment and creating new jobs. In fiscal year 2005, we request $6.5 million for international activities, a $612,000 increase from the fiscal year 2004 appropriation, which included nearly $2.7 million in funds that were earmarked to specific recipients. We propose to use these funds for a wide variety of partnership activities under the U.S. Clean Energy Initiative arising from the World Summit on Sustainable Development.

In fiscal year 2005, we request $5.5 million for the Tribal Resources Program, an increase of $594,000 over the fiscal year 2004 appropriation. The program provides assistance to Native American Tribes and Tribal entities in assessing energy resources, comprehensive energy plan development, energy technology training, and project development. This primarily involves the development of energy efficiency and renewable energy resources on Tribal lands. Projects include resource assessments and development plans for energy efficient and renewable energy technologies. Technical assistance helps Native American Tribes, and Tribal Colleges develop culturally compatible energy and economic development plans and strategies reflecting Tribal priorities. In addition, the program invests in technical program and market analysis and performance assessment in order to direct effective strategic planning. Again, this is an area where congressionally directed spending totaling $3.2 million, or more than half of our funding, inhibits our ability to issue and entertain competitive funding opportunities for tribes.

We are also requesting $4.0 million dollars for the Renewable Energy Production Incentive, which will create an incentive similar to the renewable production tax credits available to investor-owned utilities for public power providers.

DEPARTMENTAL ENERGY MANAGEMENT PROGRAM

The Departmental Energy Management Program seeks to improve energy and water efficiency, promote renewable energy use, and manage utility costs in DOE facilities and operations. The Department owns or leases about 11,000 buildings at more than 50 sites across the United States. The fiscal year 2005 request for Department Energy Management Program activities of $1.97 million, about the same as the fiscal year 2004 appropriation, will allow continued facility audits to identify energy conservation opportunities; provide funding for best practices identification and dissemination; and accomplish energy conservation retrofits through direct funding and alternative financing.

NATIONAL CLIMATE CHANGE TECHNOLOGY INITIATIVE COMPETITIVE SOLICITATION PROGRAM

This is the third year we seek funding for the Competitive Solicitation Program as part of the President's National Climate Change Technology Initiative. The competitive solicitation process will seek innovative, novel, high-impact climate change technology options that can complement and enrich the existing portfolio of climate change-related research and applied technology. By stimulating and strengthening Federal research in this area, the program hopes to inspire private sector interest and international cooperation in a sustained collaborative program of research investment aimed at accelerating technology development and advancing the administration's climate change goals. The Department is requesting $3 million in fiscal year 2005 for this initiative.

FACILITIES AND INFRASTRUCTURE

This Facilities and Infrastructure budget addresses capital requirements for capital projects, equipment and plant maintenance at the National Renewable Energy Laboratory (NREL). NREL provides state-of-the-art research facilities, user facilities, analysis, and management of R&D contracts for the Solar, Wind, Geothermal, Biomass, and Hydrogen programs within the Energy Supply budget, and does the same for the programs in the Energy Conservation budget and superconductivity research in the Office of Electricity Transmission and Distribution. NREL is home to 1,100 researchers, engineers, analysts, and administrative staff, plus visiting professionals, graduate students, and interns on a 300-acre campus in Golden, CO, occupying five large research buildings and over 200,000 square feet of research and administrative space in a neighboring office park.

The fiscal year 2005 request of $11.5 million will provide $4.8 million for operation and maintenance funded activities and $6.7 million for continued construction of the Science and Technology Facility.

PROGRAM DIRECTION

Program Direction provides the technical direction and oversight resources needed to successfully implement EERE renewable energy programs. The budget requests covers Federal staff, as well as associated properties, equipment, supplies, and materials required to support the management and oversight of programs. Areas funded by these requests include information systems and technology equipment; travel; public information activities; support service contractors; and crosscutting performance evaluation, analysis and planning.

The fiscal year 2005 budget request for Program Direction in the Energy Supply account is $20.7 million, which is $8.3 million more than the fiscal year 2004 appropriation. The increase in fiscal year 2005 will fund activities to develop and strengthen EERE's program management and project management practices at both Headquarters and field offices. A new Project Management Center that includes the Golden Field Office and other EERE field organizations is responsible for project management of research and development partnerships, laboratory contract administration including the management and operating contract for the National Renewable Energy Laboratory, and providing procurement, legal, business management, and information resource management. This Project Management Center initiative allows our Laboratories to devote more time to real research as opposed to management oversight functions, and will help our program dollars remain focused on research, development, and deployment.

The proposed increase will also provide full funding for the renewable energy programs' share of landlord services at the Golden Field Office and its fair share of Information Technology services and local-area network operations.

The budget request also includes $3 million to provide analytical and technical support services to the cross-cutting Climate Change Technology Program, a multi-agency research planning and coordination activity led by DOE.

CONCLUSION

Mr. Chairman, we believe the administration's fiscal year 2005 budget request for renewable energy technologies reflects a robust, balanced and consistent approach toward meeting the Nation's energy goals of increased energy security through utilization of diverse domestic supplies, greater freedom of choice of technology, and reduced financial costs and environmental impacts of energy utilization.

This completes my prepared statement, and I am happy to answer any questions the subcommittee may have.

OFFSHORE WIND

Senator DOMENICI. I have a series of questions, but your testimony kind of interrupted my thoughts and suggested that I ask you a question. When you mentioned offshore activities, we've run into a lot of arguing about people wanting more say-so about where these great big fields of windmills are located. In fact, we almost got an amendment on the floor. They were all waiting for me to do it and I guess I let them down to give local authority to decide yes or no.

I'm not asking you that question, but I'm saying, is there a significant growth in the complaints about where you should locate these fields and tell me a little bit about what's happening?

Mr. GARMAN. Sure. Today the regulatory structure is very, very difficult to navigate. There are a variety of State and local agencies that one has to deal with if one wants to put offshore wind in place. Offshore wind has such great promise because it is a tremendous resource that's located very close to the population and load centers, particularly on the northeast coast of the United States, and we believe wind energy could be very competitive there.

But today, unlike if you're trying to develop offshore leasing for oil and gas and you deal with only one agency, the Minerals Management Service as the lead agency to develop offshore wind you have to deal with several agencies. The Army Corps of Engineers is the lead agency, but it is very, very difficult to deal with the regulatory structure.

There is a provision in the energy bill, however, that would vest authority with the Department of the Interior to begin to manage offshore leasing for wind similar to the way they manage it for offshore outer continental shelf leasing.

Senator DOMENICI. Well, sir, you mentioned the northeast. What's the issue off the shore of Massachusetts?

Mr. GARMAN. The Cape Wind Project is a project that is probably economically viable today, but there is, of course, concern, NIMBYism, some call it, about the impact of the wind turbines on the horizon. I think wind turbines are aesthetically beautiful, but that's me. Not everybody agrees.

So we are actually developing the larger technology that could be offshore at such a distance that it couldn't be seen from shore, and I think that could help ameliorate many of the concerns that people have about the aesthetics.

Senator DOMENICI. There isn't any need that it be right close, but does it get more expensive as you go out?

Mr. GARMAN. It does because the water is deeper. But particularly in the Northeast, less so on the West Coast, you have shallow water that extends 20 or more kilometers offshore. The limit today is about 30 meters. If you go deeper than that, we don't quite have the technology today to install wind turbines.

Senator DOMENICI. Okay. Thank you very much. Dr. Orbach.

OFFICE OF SCIENCE

STATEMENT OF RAYMOND L. ORBACH, DIRECTOR

Dr. ORBACH. Mr. Chairman, members of the committee, I want to thank you for your support over the years. I look forward to

working with you to ensure that our Nation stays at the leading edge of science and technology for energy security.

The Office of Science 2005 budget request is $3.4 billion, an increase of $72 million, or 2.2 percent over the fiscal year 2004 appropriation when congressionally-directed projects are taken into account. This request allows the Office of Science to carry forward with the Department's and the administration's priorities in critical areas of science.

It enables us to begin our planning for the future of science in America through important progress on the priorities set out in the Facilities for the Future of Science report and in the Office of Science strategic plan. It increases the operation of our user facilities from 92 percent to 95 percent of optimum, enhancing our leverage for our construction investment. The full details of our budget request are provided in the written statement I have submitted.

By title, let me talk about the highlights of our budget. It will keep our Nation on the path to fusion power, with important investments in ITER and other fusion programs. It will enable investments in leadership-class machines for high-end computation, essential for America's open scientific technological research and economic development.

The President's request for the Office of Science will fund vital research enabling the hydrogen economy. The President's request provides funding for long-lead procurement of the LINAC coherent light source, an X-ray free-electron laser, which will truly provide a new window on nature.

PREPARED STATEMENT

Finally, this request provides the funding needed to initiate project engineering design activities for the GTL facility for the production and characterization of proteins and molecular tags, which promises to accelerate genomics research.

I would be delighted to answer any of your questions and I hope that my testimony can be submitted for the record. Thank you.

[The statement follows:]

PREPARED STATEMENT OF RAYMOND L. ORBACH

Mr. Chairman and Members of the subcommittee, thank you for the opportunity to testify today about the Department of Energy's Office of Science fiscal year 2005 budget request. The Department appreciates the support of the Chairman and the Members of the committee over the past years and I look forward to working with you to ensure that our Nation stays at the leading edge of science and technology.

The Office of Science fiscal year 2005 budget request is $3.4 billion, a $68.5 million decrease from the fiscal year 2004 appropriation levels. When $140.8 million for fiscal year 2004 congressionally-directed projects is set aside, there is an increase of $72.3 million in fiscal year 2005. This request makes investments in: Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), Biological and Environmental Research (BER), Fusion Energy Sciences (FES), High Energy Physics (HEP), Nuclear Physics (NP), Science Laboratories Infrastructure, Safeguards and Security, Workforce Development for Teachers and Scientists and Science Program Direction.

It allows us to increase support for high priority scientific research, increase operations at our key scientific user facilities, keep major science construction projects on schedule, and support new initiatives. This request, coming at a time of tight overall Federal budgets, is also a demonstration of the administration's support for basic research and the role that fundamental science plays in keeping our Nation strong and secure.

OFFICE OF SCIENCE FISCAL YEAR 2005 PRESIDENT'S REQUEST

[B/A in thousands]

	Fiscal Year 2003 Comparable Approp.	Fiscal Year 2004 Comparable Approp.	Fiscal Year 2005 President's Request
Science:			
Advanced Scientific Computing Research	$163,185	$202,292	$204,340
Basic Energy Sciences	1,001,941	1,010,591	1,063,530
Biological & Environmental Research	494,360	641,454	501,590
Congressionally-directed projects	(51,927)	(140,762)	.....
Core Biological and Environmental Research	(442,433)	(500,692)	(501,590)
Fusion Energy Sciences	240,695	262,555	264,110
High Energy Physics	702,038	733,631	737,380
Nuclear Physics	370,655	389,623	401,040
Science Laboratories Infrastructure	45,109	54,280	29,090
Science Program Direction	137,425	152,581	155,268
Workforce Development for Teachers & Scientists	5,392	6,432	7,660
Small Business Innovation Research/Technology Transfer	100,172	.....	.....
Safeguards and Security	61,272	56,730	67,710
Subtotal, Science	3,322,244	3,510,169	3,431,718
Use of prior year balances	.....	−10,000	.....
Total, Science	3,322,244	3,500,169	3,431,718
Total, excluding Congressionally-directed projects	(3,270,317)	(3,359,407)	(3,431,718)

I am proud to tell you that the Department of Energy was ranked the most improved cabinet-level agency in the most recent scorecard to assess implementation of the President's Management Agenda (PMA). The scorecard, which evaluates agency performance in the areas of human capital, competitive sourcing, financial management, e-government, and budget/performance integration, was issued by the Office of Management and Budget (OMB) in January and recognized the Department as one of the agencies "leading the pack with regard to management improvement."

The Department has made a strong commitment to a results-driven, performance-based approach to management of itself and its government-owned, contractor-operated laboratories. Laboratory contracts are being renegotiated so that mutually agreed upon performance measures will result in increased contractor authority and accountability, while lessening the burden of DOE day-to-day oversight of activities. In January of this year, the Department announced that it will compete the management and operating contracts for seven of the DOE laboratories.

In September 2003, the Department issued its updated Strategic Plan and incorporated this Plan and the Performance Plan into the fiscal year 2005 budget request. The performance measures included in this budget were developed with input from our scientific advisory committees and OMB. A website (www.sc.doe.gov/measures) has been developed to more fully explain the new measures within the context of each program.

SCIENCE PLANS AND PRIORITIES

When I joined the Office of Science after a career as a university scientist and administrator, I came with an appreciation for the four key roles that the Office plays in the U.S. research effort. We provide solutions to our Nation's energy challenges, contributing essential scientific foundations to the energy, national, and economic security missions of the DOE. We are the Nation's leading supporter of the physical sciences, investing in research at over 280 universities, 15 national laboratories, and many international research institutions. We deliver the premier tools of science to our Nation's science enterprise, building and operating major research facilities for open access by the science community. We help keep the United States at the forefront of intellectual leadership, supporting the core capabilities, theories, experiments, and simulations to advance science.

This fiscal year 2005 budget request will set us on the path toward addressing the challenges that face our Nation in the 21st Century. SC has recently released "Facilities for the Future of Science: A Twenty-Year Outlook" which sets an ambitious agenda for scientific discovery over the next two decades. The priorities established in this plan—which is clearly not a budget document—reflect national priorities set by the President and the Congress, our commitment to the DOE missions,

and the views of the U.S. scientific community. Pursuing these priorities will be challenging, but they hold enormous promise for the overall well-being of all of our citizens. We have recently released an updated Office of Science Strategic Plan that is fully integrated with the Facilities Plan, the Department's Strategic Plan, and the President's Management Agenda—including the R&D Investment Criteria and OMB's Program Assessment Rating Tool. The fiscal year 2005 budget request begins to implement these plans.

I am increasingly mindful that the health and vitality of U.S. science and technology depends upon the availability of the most advanced research facilities. DOE leads the world in the conception, design, construction, and operation of these large-scale devices. These machines have enabled U.S. researchers to make some of the most important scientific discoveries of the past 70 years, with spin-off technological advances leading to entirely new industries. More than 19,000 researchers and their students from universities, other government agencies (including the National Science Foundation and the National Institutes of Health), private industry, and those from abroad use DOE facilities each year. These users are growing in both number and diversity.

Because of the extraordinarily wide range of scientific disciplines required to support facility users at national laboratories, and the diversity of mission-driven research supported by the SC, we have developed an interdisciplinary capability that is extremely valuable to some of the most important scientific initiatives of the 21st Century. There is also a symbiotic relationship between research and research tools. Research efforts advance the capabilities of the facilities and tools that in turn enable new avenues of research.

Excluding funds used to construct or operate our facilities, approximately half of our research funding goes to support research at universities and institutes. Academic scientists and their students are funded through peer-reviewed grants, and SC's funding of university research has made it an important source of support for graduate students and postdoctoral researchers in the physical sciences during their early careers.

Mindful of the role that the Office of Science plays in supporting the physical sciences and other key fields, I would now like to briefly outline some specific investments that we are proposing in the Fiscal Year 2005 Request.

SCIENCE PROGRAMS

ADVANCED SCIENTIFIC COMPUTING RESEARCH

Fiscal Year 2004 Comparable Appropriation—$202.3M; Fiscal Year 2005 Request—$204.3M

The Advanced Scientific Computing Research (ASCR) program significantly advances scientific simulation and computation, applying new approaches, algorithms, and software and hardware combinations to address the critical science challenges of the future, and provides access to world-class, scientific computation and networking facilities to the Nation's scientific community to support advancements in practically every field of science and industry. The ASCR budget also supports the Scientific Discovery through Advanced Computing (SciDAC) program—a set of coordinated investments across all Office of Science mission areas with the goal of achieving breakthrough scientific advances via computer simulation that were previously impossible using theoretical or laboratory studies alone.

The fiscal year 2005 budget request includes $204.3 million for ASCR to advance U.S. leadership in high performance supercomputing and networks for science and to continue to advance the transformation of scientific simulation and computation into the third pillar of scientific discovery. The request includes $38.2 million for the Next Generation Computer Architecture (NGA) research activity, which is part of a coordinated interagency effort that supports research, development and evaluation of new architectures for scientific computers that could help enable continued U.S. leadership in science. Enhancements are supported for ASCR facilities—the Energy Sciences Network (ESnet) and the National Energy Research Scientific Computing Center (NERSC). The request also includes $8.5 million for the new Atomic to Macroscopic Mathematics research effort to provide the research support in applied mathematics needed to break through the current barriers in our understanding of complex physical processes.

BASIC ENERGY SCIENCES

Fiscal Year 2004 Comparable Appropriation—$1,010.6M; Fiscal Year 2005 Request—$1,063.5M

The Basic Energy Sciences (BES) program is a principal sponsor of fundamental research for the Nation in the areas of materials sciences and engineering, chemistry, geosciences, and bioscience as it relates to energy. This research underpins the DOE missions in energy, environment, and national security; advances energy-related basic science on a broad front; and provides unique user facilities for the scientific community and industry.

For fiscal year 2005, the Department requests $1.1 billion for BES including $208.6 million to continue to advance nanoscale science through atomic- and molecular-level studies in materials sciences and engineering, chemistry, geosciences, and energy biosciences. This supports Project Engineering Design (PED) and construction of four Nanoscale Science Research Centers (NSRC's) and a Major Item of Equipment for the fifth and final NSRC. NSRC's are user facilities for the synthesis, processing, fabrication, and analysis of materials at the nanoscale. The request also includes $80.5 million for construction and $33.1 million for other project costs for the Spallation Neutron Source, and $54.1 million for research, development, PED, and long lead procurement of the Linac Coherent Light Source, a revolutionary x-ray laser light source. With these tools, we will be able to understand how the compositions of materials affect their properties, watch proteins fold, see chemical reactions, and design matter for desired outcomes.

The fiscal year 2005 budget request also includes $29.2 million for activities that support the President's Hydrogen Fuel Initiative. This research program is based on the BES workshop report "Basic Research Needs for the Hydrogen Economy," which highlights the enormous gap between our present capabilities and those required for a competitive hydrogen economy.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

Fiscal Year 2004 Comparable Appropriation—$641.5M; Fiscal Year 2005 Request—$501.6M

The Biological and Environmental Research (BER) program advances energy-related biological and environmental research in genomics and our understanding of complete biological systems, such as microbes that produce hydrogen; in climate change, including the development of models to predict climate over decades to centuries; developing science-based methods for cleaning up environmental contaminants; in radiation biology, providing regulators with a stronger scientific basis for developing future radiation protection standards; and in the medical sciences, by developing new diagnostic and therapeutic tools, technology for disease diagnosis and treatment, non-invasive medical imaging, and biomedical engineering such as an artificial retina that will restore sight to the blind. For fiscal year 2005, the Department requests $501.6 million for BER. The fiscal year 2004 appropriation includes $140.8 million of one-time Congressionally-directed projects, for which no additional funds are being requested in fiscal year 2005.

Research on microbes through the Genomics: GTL program, addressing DOE energy and environmental needs, continues to expand from $63.5 million in fiscal year 2004 to $67.5 million in fiscal year 2005. The request also provides $5 million for initiation of Project Engineering Design (PED) activities for the GTL Facility for the Production and Characterization of Proteins and Molecular Tags, a facility that will help move the Genomics: GTL systems biology research program to a new level by greatly increasing the rate and cost-effectiveness with which experiments can be done. DOE, through the Genomics: GTL program, will attempt to use genetic techniques to harness microbes to consume pollution, create hydrogen, and absorb carbon dioxide.

FUSION ENERGY SCIENCES

Fiscal Year 2004 Comparable Appropriation—$262.6M; Fiscal Year 2005 Request—$264.1M

The Fusion Energy Sciences (FES) program advances the theoretical and experimental understanding of plasma and fusion science, including a close collaboration with international partners in identifying and exploring plasma and fusion physics issues through specialized facilities. This includes: (1) exploring basic issues in plasma science; (2) developing the scientific basis and computational tools to predict the behavior of magnetically confined plasmas; (3) using the advances in tokomak research to enable the initiation of the burning plasma physics phase of the Fusion Energy Sciences program; (4) exploring innovative confinement options that offer

the potential of more attractive fusion energy sources in the long term; (5) focusing on the scientific issues of nonneutral plasma physics and High Energy Density Physics; (6) developing the cutting edge technologies that enable fusion facilities to achieve their scientific goals; and (7) advancing the science base for innovative materials to establish the economic feasibility and environmental quality of fusion energy.

When the President announced that the United States would join in the International Thermonuclear Experimental Reactor (ITER) project he noted that "the results of ITER will advance the effort to produce clean, safe, renewable, and commercially available fusion energy by the middle of this century." To this end, the Department continues its commitment to the future of Fusion Energy Science research with a request of $264.1 million, slightly above the fiscal year 2004 enacted level. Within that amount, $38 million is requested for preparations for ITER in fiscal year 2005, $30 million more than in fiscal year 2004. Of this $38 million, $7 million is for scientists and engineers who will support the International Team and for the qualification of vendors that will supply superconducting cable for ITER magnets. The remaining $31 million will be used to support refocused experiments in our tokamak facilities and for component R&D in our laboratories and universities that is closely related to our ongoing program but which is focused on ITER's specific needs. The researchers and facilities that we support will not be doing less work because of ITER, but some of their time and effort will be directed to different, ITER-related, work than they were doing before.

Fabrication continues on the National Compact Stellarator Experiment (NCSX), an innovative confinement system that is the product of advances in physics understanding and computer modeling. In addition, work will be initiated on the Fusion Simulation Project that, upon completion, will provide an integrated simulation and modeling capability for magnetic fusion energy confinement systems over a 15-year development period. The Inertial Fusion Energy research program will be redirected toward high energy density physics research based on recommendations that will come from the recently established Interagency Task Force on High Energy Density Physics.

HIGH ENERGY PHYSICS

Fiscal Year 2004 Comparable Appropriation—$733.6M; Fiscal Year 2005 Request—$737.4M

The High Energy Physics (HEP) program advances our understanding of the basic constituents of matter, including the mysterious dark energy and dark matter that make up most of the universe; the striking imbalance of matter and antimatter in the universe, and the possible existence of other dimensions. Collectively, these investigations will reveal the key secrets of the birth, evolution, and final destiny of the universe. HEP expands the energy frontier with particle accelerators to study fundamental interactions at the highest possible energies, which may reveal previously unknown particles, forces or undiscovered dimensions of space and time; explain how everything came to have mass; and illuminate the pathway to the underlying simplicity of the universe.

For fiscal year 2005, the Department requests $737.4 million for the HEP program, an increase from fiscal year 2004. The highest priority in HEP is the operation, upgrade and infrastructure for the two major HEP user facilities at the Fermi National Accelerator Laboratory (Fermilab) and the Stanford Linear Accelerator Center (SLAC), to maximize the scientific data generated.

In 2005, the Neutrinos at the Main Injector (NuMI) facility will be complete and the beam line will be commissioned. The fiscal year 2005 budget request also supports research and design activities for a new Major Item of Equipment, the BTeV ("B Physics at the TeVatron") experiment at Fermilab that will extend current investigations, using modern detector technology to harvest a data sample more than 100 times larger than current experiments. Research and development work continues in fiscal year 2005 on the proposed Supernova Acceleration Probe (SNAP) experiment for the DOE/NASA Joint Dark Energy Mission (JDEM).

NUCLEAR PHYSICS

Fiscal Year 2004 Comparable Appropriation—$389.6M; Fiscal Year 2005 Request—$401M

The Nuclear Physics (NP) program supports innovative, peer reviewed scientific research to advance knowledge and provide insights into the nature of energy and matter, and in particular, to investigate the fundamental forces which hold the nucleus together, and determine the detailed structure and behavior of the atomic nuclei. Nuclear science plays a vital role in studies of astrophysical phenomena and

conditions of the early universe. At stake is a fundamental grasp of how the universe has evolved, an understanding of the origin of the elements, and the mechanisms of supernovae core collapse. The program builds and supports world-leading scientific facilities and state-of-the-art instruments necessary to carry out its basic research agenda. Scientific discoveries at the frontiers of Nuclear Physics further the Nation's energy-related research capacity, which in turn provides for the Nation's security, economic growth and opportunities, and improved quality of life.

The fiscal year 2005 budget request of $401 million gives highest priority to exploiting the unique discovery potentials of the facilities at the Relativistic Heavy Ion Collider (RHIC) and Continuous Electron Beam Accelerator Facility (CEBAF) by increasing operating time by 26 percent compared with fiscal year 2004. R&D funding is provided for the proposed Rare Isotope Accelerator (RIA) and 12 GeV upgrade of CEBAF, which is located at Thomas Jefferson National Accelerator Facility.

Operations of the MIT/Bates facility will be terminated as planned, following 3 months of operations in fiscal year 2005 to complete its research program. This facility closure follows the transitioning of operations of the Lawrence Berkeley National Laboratory 88-Inch Cyclotron in fiscal year 2004 from a user facility to a dedicated facility for the testing of electronic circuit components for use in space (using funds from other agencies) and a small in-house research program. These resources have been redirected to better utilize and increase science productivity of the remaining user facilities and provide for new opportunities in the low-energy subprogram.

SCIENCE LABORATORIES INFRASTRUCTURE

Fiscal Year 2004 Comparable Appropriation—$54.3M; Fiscal Year 2005 Request—$29.1M

The Science Laboratories Infrastructure (SLI) program supports SC mission activities at SC laboratories by addressing needs related to general purpose infrastructure, excess facilities disposition, Oak Ridge landlord, health and safety improvements and payment in lieu of taxes (PILT).

The fiscal year 2005 budget request supports three ongoing line item construction projects at Lawrence Berkeley National Laboratory, Brookhaven National Laboratory and the Stanford Linear Accelerator Center and nine projects to clean-up/remove 84,000 square feet of excess space to reduce operating costs, and environment, safety and health liabilities, and to free up land for future use. The request also supports activities to maintain continuity of operations at the Oak Ridge Reservation (ORR), including Federal facilities in the town of Oak Ridge and PILT for local communities surrounding Oak Ridge. PILT is also provided to communities surrounding Brookhaven and Argonne East.

We have continued to work cooperatively with the Occupational Safety and Health Administration (OSHA) and the Nuclear Regulatory Commission (NRC) teams as they have conducted audits of our laboratories. NRC has completed its audits; OSHA is expected to complete its audits in mid-March 2004. The laboratories are preparing cost estimates to meet the requirements as identified by those agencies, and we plan to provide this information to Congress by May 31, 2004. Health and safety improvements to address OSHA- and NRC-identified deficiencies and recommendations at Office of Science laboratories are expected to be completed in fiscal year 2004.

SAFEGUARDS AND SECURITY

Fiscal Year 2004 Comparable Appropriation—$56.7M; Fiscal Year 2005 Request—$67.7M

Safeguards and Security activities reflects the Office of Science's commitment to maintain adequate protection of cutting edge scientific resources and assets. The fiscal year 2005 budget request includes $9.8 million for Pacific Northwest Site Office safeguards and security activities, which were transferred from the Office of Environmental Management. In fiscal year 2005, Safeguards and Security will enable the Office of Science laboratories to meet the requirements of Security Condition 3 level mandates for the protection of assets. The request also provides the laboratories with the ability to maintain requirements of increased Security Condition 2 level for 60 days. The funding includes the increase needed to meet expectations of the revised Design Basis Threat approved by the Secretary in May 2003. In addition, critical cyber security investments will be made to respond to the ever changing cyber threat.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

Fiscal Year 2004 Comparable Appropriation—$6.4M; Fiscal Year 2005 Request—$7.7M

The mission of the Workforce Development for Teachers and Scientists program is to continue the Office of Science's long-standing role of training young scientists, engineers, and technicians in the scientifically and technically advanced environments of our National Laboratories.

The fiscal year 2005 budget request of $7.7 million provides $1.5 million for a Laboratory Science Teacher Professional Development activity. About 90 participating teachers will gain experience and enhance their skills at five or more DOE laboratories in response to the national need for science teachers who have strong content knowledge in the classes they teach. A new $500,000 Faculty Sabbatical Fellowship activity will provide sabbatical opportunities for 12 faculty from minority serving institutions (MSI's). This proposed activity is an extension of the successful Faculty and Student Teams (FaST) program where teams of faculty members and two or three undergraduate students, from colleges and universities with limited prior research capabilities, work with mentor scientists at a National Laboratory to complete a research project that is formally documented in a paper or presentation.

SCIENCE PROGRAM DIRECTION

Fiscal Year 2004 Comparable Appropriation—$152.6M; Fiscal Year 2005 Request—$155.3M

The mission of Science Program Direction is to provide a Federal workforce, skilled and highly motivated, to manage and support basic energy and science-related research disciplines, diversely supported through research programs, projects, and facilities under the Office of Science's leadership.

Science Program Direction consists of two subprograms: Program Direction and Field Operations. The Program Direction subprogram is the single funding source for the SC Federal staff in Headquarters responsible for directing, administering, and supporting the broad spectrum of scientific disciplines. This subprogram also includes program planning and analysis activities which provide the capabilities needed to evaluate and communicate the scientific excellence, relevance, and performance of SC basic research programs.

The Field Operations subprogram is the centralized funding source for the SC Federal workforce in the field who are responsible for providing business, administrative, and specialized technical support to SC and other DOE programs. Our service centers in Chicago and Oak Ridge provide primary support to SC laboratories and facilities, including Ames, Argonne National Laboratory, Brookhaven National Laboratory, Lawrence Berkeley National Laboratories, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Fermilab, Princeton Plasma Physics Laboratory, Thomas Jefferson National Accelerator Facility, and Stanford Linear Accelerator Center.

Secretary Abraham approved the Office of Science Restructuring (OneSC) on January 5, 2004. OneSC was initiated in July 2002 to embrace the changes envisioned by the President's Management Agenda (PMA) to accomplish government programs more economically and effectively by creating a new, more efficient, and productive SC organization. It will also provide a management environment for SC employees in which their success and high performance can continue in the face of changing resources, requirements, and societal needs.

The fiscal year 2005 budget request of $155.3 million represents a 1.8 percent increase over the fiscal year 2004 enacted level. This increase is reflected in salaries and benefits to support a total SC workforce of 1,014 full-time equivalents (FTE's). Compared to fiscal year 2004, the fiscal year 2005 request is flat or lower in our other major budget categories, such as travel, training, support services, and other related expenses. We will continue to leverage resources and rely on building good business practices by streamlining operations, improving financial controls, and reengineering business processes in support of the PMA and the OneSC structure.

CONCLUSION

The Office of Science occupies a unique and critical role within the U.S. scientific enterprise. We fund research projects in key areas of science that our Nation depends upon. We construct and operate major scientific user facilities that scientists from virtually every discipline are using on a daily basis, and we manage civilian national laboratories that are home to some of the best scientific minds in the world.

Our researchers are working on many of the most daunting scientific challenges of the 21st Century. These include pushing the frontiers of the physical sciences

through nanotechnology and exploring the key questions at the intersection of physics and astronomy. We are also pursuing opportunities at the intersection of the physical sciences, the life sciences, and scientific computation to understand how the instructions embedded in genomes control the development of organisms, with the goal of harnessing the capabilities of microbes and microbial communities to help us to produce energy, clean up waste, and sequester carbon from the atmosphere. The Office of Science is also pushing the state-of-the-art in scientific computation, accelerator R&D, plasma confinement options and a wide array of other technologies that advance research capabilities and strengthen our ability to respond to the rapidly changing challenges ahead.

I want to thank you, Mr. Chairman, for providing this opportunity to discuss the SC's research programs and our contributions to the Nation's scientific enterprise. This concludes my testimony. I would be pleased to answer any questions you might have.

Senator DOMENICI. Is this your product?

Dr. ORBACH. Yes, it is, sir.

Senator DOMENICI. Facilities for Future of Science 20-Year Outlook. I think it's terrific.

[CLERK'S NOTE.—The document entitled, "Facilities for the Future of Science: A Twenty-Year Outlook" can be found at http://www.sc.doe.gov/sub/Facilities_For_Future/20-Year-Outlook_screen.pdf.]

Dr. ORBACH. Thank you.

Senator DOMENICI. I'm very sorry that it doesn't get more use and more exposure and maybe you might just tell me, how does it get around?

Dr. ORBACH. Well, we've been distributing it at each of the meetings that I attend around the country. We have made major press announcements and we have submitted it to scientific organizations not only in the United States but also abroad.

Also our current budget request enables us to begin the top six of our priorities at different stages depending on R&D, so we're beginning to put it into play.

Senator DOMENICI. Great.

Dr. ORBACH. Thank you for your comment.

Senator DOMENICI. Mr. Magwood, would you proceed with kind of dispatch on your statement, because we've got a lot of questions.

OFFICE OF NUCLEAR ENERGY, SCIENCE AND TECHNOLOGY

STATEMENT OF WILLIAM D. MAGWOOD, IV, DIRECTOR

Mr. MAGWOOD. Be happy to, Mr. Chairman. I do have a written statement for the record. Let me very briefly summarize my remarks because I know you're very familiar with our program activities.

NUCLEAR ENGINEERING PROGRAMS

I want to take a look back. When you think about where we started from back in 1998, when you and I spoke about the pretty dire situation facing the nuclear energy program run by the Federal Government, at that time our research budget plummeted to zero; students entering nuclear engineering programs had gone down to 500 from 1,500 just a few years earlier; and many countries that had seen the United States as a principal partner for nuclear energy research and development had turned away from us and had begun to think of the United States as being basically a past partner.

Over the last several years, this has turned around significantly. I think there's been a lot of success to look back on. Looking at it today, the number of nuclear engineering students now are 1,400 in universities across the country. This is a huge accomplishment considering where we were a few years ago.

Senator DOMENICI. How many?

Mr. MAGWOOD. One thousand, four hundred. Almost as——

Senator DOMENICI. Studying what?

Mr. MAGWOOD. Nuclear engineering. So that's almost completely reversed from the climate of the 1990's.

Senator DOMENICI. But now we went like that and we're going to stop growing.

Mr. MAGWOOD. No, we want to keep growing. We think we're in good shape. As a matter of fact, we are actually starting new programs in nuclear engineering across the country at schools like the University of South Carolina, South Carolina State and even—I'm sorry that Mr. Reid's not here—University of Nevada Las Vegas is looking at starting a new nuclear engineering program.

On our side, the research that we're pursuing in Generation IV nuclear power systems has really taken off. We're working with our international partners very closely and we're very optimistic about the direction that that work has taken.

PREPARED STATEMENT

You may know, Mr. Chairman, that I was recently elected chairman of the Generation IV International Forum and also the OECD steering committee on nuclear energy, and in those positions I've been able to really leverage our activities with those of our international partners; and we think that the ability to work with our international partners to pursue advanced technologies, including the possible pursuit of a project at our Idaho site to look at an advanced hydrogen electricity production reactor, is something that's well within our grasp.

So I'll just leave it at that. We've appreciated your leadership over the years and look forward to any questions you have.

[The statement follows:]

PREPARED STATEMENT OF WILLIAM D. MAGWOOD, IV

Mr. Chairman, Senator Reid, and Members of the subcommittee, it is a pleasure to be here to discuss the fiscal year 2005 budget submission for DOE's Office of Nuclear Energy, Science and Technology.

The program has made a great deal of progress over the past several years. From the time, not so many years ago, when it appeared that the United States might abandon advanced nuclear research and development, we have been successful in reasserting U.S. leadership in the world. Representing the United States, I have been elected by my international colleagues to serve as the chair of two important international bodies—the OECD Steering Committee on Nuclear Energy and the Generation IV International Forum. When it appeared that nuclear power's era had ended in the United States, nuclear utilities have turned their programs around, making more energy last year than at any time in history and launching into very serious discussions to explore the construction of new plants for the first time in decades.

Recent developments have been encouraging. The Department has launched the process of establishing a central laboratory for nuclear research and development—the Idaho National Laboratory. We are also exploring the possible construction of a pilot Generation IV nuclear plant at our new lab that will demonstrate highly efficient electricity production and pave the way to realize the President's vision of a future hydrogen economy.

The Department's fiscal year 2005 request for the nuclear energy program proposes a $410 million investment in nuclear research, development and infrastructure for the Nation's future that is designed to continue this progress. This budget request moves forward the Department's commitment to support the President's priorities to enhance the Nation's energy independence and security while enabling significant improvements in environmental quality. Our request supports development of new nuclear generation technologies and advanced energy products that provide significant improvements in sustainability, economics, safety and reliability, and proliferation and terrorism resistance.

We are committed to efficiently managing the funds we are given. We have abandoned outdated paradigms to integrate the Idaho Operations Office with our headquarters organization, enabling us to manage our responsibilities in the field to achieve greater quality and efficiency than would otherwise be possible. We are enhancing our expertise in critical areas such as project management through training and certification of existing staff and the acquisition of experienced, proven managers. We continue to implement the President's Management Agenda (PMA) by further integrating budget and performance, improving Program Assessment Rating Tool (PART) scores for our research and development programs, and linking major program goals in the performance plans for our Senior Executives and technical staff. These improvements are challenging and time-consuming, but we feel they must be done to assure our program's ability to make the best use of the taxpayer dollars.

While we have made great progress in all these areas, much remains to be done. Our fiscal year 2005 request moves us in the right direction and I will now provide you a full report of our activities and explain the President's request for nuclear energy in detail.

GENERATION IV NUCLEAR ENERGY SYSTEMS

Our Generation IV effort continues to make significant progress. Since the Generation IV International Forum and the Nuclear Energy Research Advisory Committee (NERAC) issued their joint report, "A Technology Roadmap for Generation IV Nuclear Energy Systems", the members of the Forum have expanded to include Switzerland and the European Union. The now 11 members (Argentina, Brazil, Canada, the European Union, France, Japan, the Republic of Korea, the Republic of South Africa, Switzerland, the United Kingdom and the United States) have organized into interest groups associated with each of the six selected Generation IV systems and are negotiating international legal agreements to enable advanced nuclear research to be conducted on a multilateral basis.

We hope to complete these negotiations later this year and move forward with these countries to develop advanced reactor technologies for commercial deployment in the 2015 to 2030 timeframe. Generation IV concepts offer significant improvements in sustainability, proliferation resistance, physical protection, safety and economics. These advanced systems will not only be safe, economic and secure, but will also include energy conversion systems that produce valuable commodities such as hydrogen, desalinated water and process heat. These features make Generation IV reactors ideal for meeting the President's energy and environmental objectives.

As indicated in our recent report to Congress on our implementation strategy for the Generation IV program, while the Department is involved in research on several reactor concepts, our efforts and this budget proposal place priority on development of the Next Generation Nuclear Plant (NGNP). The NGNP is based on the union of the Very-High-Temperature Reactor concept in the Generation IV Roadmap with advanced electricity and hydrogen production technologies. We are exploring the potential of an international, public-private project to build and operate a pilot NGNP at the Department's Idaho site. While the Department has not made a decision to proceed with this effort, such a project could validate the potential of this technology to contribute to meeting to goals of the President's Hydrogen Fuel Initiative. If successful, this technology could produce hydrogen at a cost that is competitive with gasoline and electricity and with advanced natural gas-fired systems.

The Idaho National Laboratory and several other labs will also explore a range of other Generation IV concepts principally the Supercritical Water-Cooled Reactor, the Gas-Cooled Fast Reactor and the Lead-Cooled Fast Reactor. Our efforts will focus on establishing technical and economic viability, and developing core and fuel designs, and advanced materials for these concepts. We are also working with our colleagues in the Office of Science to assemble a joint Future Energy Advanced Materials Initiative aimed at the development of new materials for advanced fission and fusion energy systems. The fiscal year 2005 request enables progress on this broad front. With your support, and the leveraging of our resources with those of

our international partners, we expect to make continued progress toward developing world-changing technologies.

NUCLEAR HYDROGEN INITIATIVE

Hydrogen offers significant promise as a future energy technology, particularly for the transportation sector. The use of hydrogen in transportation will reduce U.S. dependence on foreign sources of petroleum, enhancing national security. Significant progress in hydrogen combustion engines and fuel cells is making transportation using hydrogen a reality. Today, through electrolysis, we can convert water to hydrogen using electricity. We believe that for the future, Very-High-Temperature Reactors coupled with thermo-chemical or high-temperature electrolytic water splitting processes offer a more efficient technology for production of large quantities of hydrogen without release of greenhouse gases. The goal of the Nuclear Hydrogen Initiative is to develop economic, commercial-scale production of hydrogen using nuclear energy.

With funding of $9 million in fiscal year 2005, the Nuclear Hydrogen Initiative will progress toward the development and demonstration of closed, sulfur-based cycles, such as the sulfur-iodine process. These processes have been demonstrated on a bench scale at somewhat lower temperatures and pressures than would be required for economic hydrogen production, but they show considerable promise, especially when they are considered for mating to Very-High-Temperature Reactor systems. We will also explore high-temperature electrolysis, which uses electricity to split high-temperature steam into hydrogen and oxygen, similar to a fuel cell operating in reverse (specifically a solid-oxide fuel cell, SOFC). High-temperature electrolysis requires much less fundamental R&D, but the ability of the process to scale economically must be demonstrated.

Finally, a major effort will be pursued in fiscal year 2005 to explore materials for hydrogen production processes which must endure high temperatures and very corrosive environments while maintaining structural integrity at low costs. Included in this effort will be our work to explore new membranes that can increase the efficiencies of the hydrogen production processes.

ADVANCED FUEL CYCLE INITIATIVE

Of the issues affecting future expansion of nuclear energy in the United States and worldwide, none is more important or more difficult than that of dealing effectively with spent nuclear fuel. After a long and difficult process, the United States is moving forward with a geologic repository, and the Department is on schedule to submit a license application to the Nuclear Regulatory Commission by the end of 2004.

Research on improving ways to treat and utilize materials from spent nuclear fuel will allow the Department to optimize the first repository, and delay—and perhaps even eliminate—the need for future repositories. The Advanced Fuel Cycle Initiative, with an investment of $46 million for fiscal year 2005, will continue the progress made in the development of proliferation-resistant treatment and transmutation technologies that can reduce both the volume and toxicity of spent nuclear fuel. These technologies would support both national security and energy independence by reducing inventories of commercially-generated plutonium while recovering residual energy value from spent nuclear fuel. If successful, these same technologies offer benefits of enhancing national security by reducing inventories of commercially-generated plutonium and enhancing energy independence by recovering the energy value contained in spent nuclear fuel.

The program has already enjoyed considerable success. We have proven the ability of our UREX technology to separate uranium from spent fuel at a very high level of purity and also shown that a derivative, UREX+, can separate a combined mixture of plutonium and neptunium that can serve as the basis for a proliferation-resistant fuel for light water reactors.

The Department's research efforts are leading to the demonstration of proliferation-resistant fuel treatment technologies to reduce the volume and radioactivity of high level waste, and the development of advanced fuels that would enable consumption of plutonium using existing light water reactors or advanced reactors. We have tested proliferation-resistant nitride and metal transmutation fuels in the Advanced Test Reactor and are currently testing mixed-oxide fuels such as would be derived from the UREX+ process.

For the Advanced Fuel Cycle Initiative to be successful, advanced fuel treatment and transmutation research and development must be integrated with the development of Generation IV nuclear energy systems, particularly with those reactor technologies that can produce very high energy neutrons that would be needed to trans-

mute a wide variety of toxic radioactive species. We have organized our national labs, universities, and international collaborations in a manner that will enable this work to proceed in a coordinated manner.

NUCLEAR POWER 2010

The President's Budget supports continuation of Nuclear Power 2010 in fiscal year 2005 to demonstrate, in cost-shared cooperation with industry, key regulatory processes associated with licensing and building new nuclear plants in the United States by the end of the decade. The requested funds of $10 million would support the activities associated with achieving NRC approval of early site permits and the development of Combined Construction and Operating License applications. (It is also critical that the Department identify the business conditions under which power generation companies would add new nuclear capacity and determine appropriate strategies to enhance such investment. In fiscal year 2005, the Department will continue to evaluate and develop strategies to mitigate specific financial risks associated with the deployment of new nuclear power plants.)

In December, the Department issued a solicitation inviting proposals from teams led by power generation companies to initiate New Nuclear Plant Licensing Demonstration Projects. Under these cost-shared projects, power companies will conduct studies, analyses, and other activities necessary to select an advanced reactor technology and prepare a site-specific, technology-specific Combined Operating License application. These projects will provide for NRC design certification and other activities to license a standardized nuclear power plant design. The Department expects to award at least one project in this fiscal year. The focus of activities in fiscal year 2005 for these projects will be on development of the Combined Operating License application.

UNIVERSITY REACTOR FUEL ASSISTANCE AND SUPPORT

The Department is very pleased with the progress we have made in reversing the decline in nuclear engineering in the United States. With significant support and encouragement from this body and your colleagues in the House of Representatives, we have played a large role in completely reversing the decline in undergraduate enrollments in this area of study that began in 1993 and continued through 1998. In 1998, the United States saw only around 500 students enroll as nuclear engineers—down from almost 1,500 in 1992. After several years of focused effort, the United States now has over 1,300 students studying nuclear engineering. That number is set to increase further, as strong programs—such as at Purdue and Texas A&M—continue to grow and we see new programs start at schools such as South Carolina State University, the University of South Carolina, and the University of Nevada-Las Vegas.

The growth of nuclear energy in the United States is dependent on the preservation of the education and training infrastructure at universities. The research conducted using these reactors is critical to many national priorities. Currently, there are 27 operating university research reactors at 26 campuses in 20 States. These reactors are providing support for research in such diverse areas as medical isotopes, human health, life sciences, environmental protection, advanced materials, lasers, energy conversion and food irradiation.

The most exciting development in University Reactor Infrastructure and Education Assistance is the Innovations in Nuclear Infrastructure and Education (INIE) Program established in fiscal year 2002. In fiscal year 2003, two additional university consortia were awarded, bringing the total to six INIE grants, providing support to 24 universities in 19 States across the Nation. The consortia have demonstrated remarkable collaborative efforts and strong formation of strategic partnerships between universities, national laboratories, and industry. These partnerships have resulted in increased use of the university nuclear reactor research and training facilities, upgrading of facilities, increased support for students, and additional research opportunities for students, faculty and other interested researchers. We are very pleased that the President's Budget includes $21 million for the University Reactor Infrastructure and Education Assistance program for fellowships, scholarships, nuclear engineering research, and for critical support to university research reactors, all of which will help address this shortage of well-trained nuclear scientists. (We have modified the structure of this program for fiscal year 2005. I am pleased to report that the President's request includes a small but important element to provide scholarships and graduate fellowships to students studying the vital and too-often overlooked discipline of health physics. The Department is concerned that the Nation may soon not have the trained health physicists who are needed to assure the safety of all nuclear and radiological activities. With this budget, we begin build-

ing a program to reverse the negative trends in this field as we have already done in nuclear engineering.)

In another change, we will transfer responsibility for the shipment of spent research reactor fuel to the Office of Civilian Radioactive Waste Management, which is to become the Department's central expertise in the management of spent fuel.

One final note in this regard, Mr. Chairman. I am sure that you have noticed that no funding is requested for the Nuclear Energy Research Initiative (NERI) in fiscal year 2005. While this program has successfully spurred U.S. nuclear energy R&D, we believe that the time has now come to integrate the program into our mainstream R&D programs. We will continue to make peer-reviewed NERI awards to university-based researchers who work in areas relevant to our Generation IV, Nuclear Hydrogen, and Advanced Fuel Cycle Initiative programs. With this step, we will engage NERI researchers at universities in the exciting, first-class research we are pursuing in cooperation with countries all over the world.

RADIOLOGICAL FACILITIES MANAGEMENT

This budget request also includes $69.1 million to maintain critical research, isotope and space and national security power systems facilities at Oak Ridge National Laboratory, Los Alamos National Laboratory, Sandia National Laboratory, and Brookhaven National Laboratory in a safe, secure, and cost effective manner to support national priorities.

The fiscal year 2005 budget request also includes $20.6 million to continue baseline operations and begin construction of the Uranium-233 project at Oak Ridge National Laboratory. This project is aimed at stabilizing materials left over from the Cold War to address a Defense Nuclear Facilities Safety Board recommendation, while extracting isotopes from the uranium that are needed for very promising medical research.

INL—DOE'S COMMAND CENTER FOR NUCLEAR R&D

This budget supports the Secretary's realignment of the mission of the Idaho National Engineering and Environmental Laboratory to focus the future of the site on nuclear research and development. The Department is in the process of establishing the Idaho National Laboratory, which will combine the resources of the INEEL and the Argonne-West site. As the Department's leading center of nuclear research and development, a core mission of this laboratory is advanced nuclear reactor and fuel cycle technologies, including the development of space nuclear power and propulsion technologies. The new Idaho National Laboratory will play a vital role in the research and development of enabling technologies for the Next Generation Nuclear Plant, which will support the Department's long-term vision of a zero-emissions future free of reliance on imported energy.

The Department issued a request for proposals in February to find a management team to reduce costs and build expertise at the INL. The Department's nuclear energy program involves the collective talents of universities, the private sector, international partners and many of our other national laboratories—Argonne, Los Alamos, Sandia and Oak Ridge among them. However, the rebuilding of the Department's nuclear power research and development program will be centered at INL. While environmental cleanup remains an important focus at the Idaho site, real progress is being made that will aid in the expansion of nuclear research and development.

Developing a central research laboratory is a major step forward for the nuclear energy program. We will join the other key energy programs at the Department by having a central, dedicated research site at which we can centralize our infrastructure investments and build the expertise needed to accomplish our program goals. A central lab also helps us minimize the shipment of nuclear materials across the country and allows us to bring our nuclear materials together in a single, secure location. We also expect that our new lab will become a major player in the education of the next generation of nuclear energy technologists that this Nation will need to assure our energy security in the future.

CONCLUSION

This concludes my prepared statement. Your leadership and guidance has been essential to the progress the program has achieved thus far and your support is needed as we engage the tasks ahead.

I would be pleased to answer any questions you may have.

Senator DOMENICI. Thank you very much. Well, the fact that we've started at nothing and put these things in is a good thing

to repeat, but it's pretty pathetic when you note that most of them were things everybody knew we needed. It wasn't like this was a vision from on high, and every year because they didn't come out of the administration made it harder and harder to fund them. And now when we get a tighter and tighter budget, it's, you know, they're the easiest ones to choke.

So, you know, you're getting 20 and 30 percent cuts in yours, while over here on the side they're saying we're for nuclear energy, right? You don't have to comment. You work for the administration.

STATEMENT OF SENATOR PATTY MURRAY

Senator Murray, I note you're on a tough time schedule and I'm most appreciative you would come today so I yield to you.

PACIFIC NORTHWEST NATIONAL LABORATORY FACILITIES

Senator MURRAY. Well, thank you very much, Mr. Chairman. Thank you for your tremendous work on this committee over the years and your leadership in many directions. I just have a couple of questions for Dr. Orbach today. Dr. Orbach, you note the Pacific Northwest National Laboratory, PNNL. In my State it's one of the Department of Energy's multi-program laboratories and is under your stewardship at the—as Director of Science.

PNNL is a very valuable asset to the State of Washington and it's going to be an enduring asset to the Tri-Cities community after Hanford clean-up is completed. I think you know there's been considerable concern over the schedule for the cleaning up of the 300 area and the replacement of the many facilities that currently house approximately 1,000 staff at PNNL. That space, I think it's 700,000 square feet, represents a third of PNNL's total laboratory space.

The Tri-Party Agreement required clean-up of the Columbia River corridor including that 300 area by 2018. As I understand it, current proposed clean-up contracts assume a 2012 or 6-year earlier completion date. That would require those 1,000 PNNL employees to exit the 300 area facility by 2007. This budget, the fiscal year 2005 budget, has no funding for replacement facilities in the 300 area and I see no scenario where new facilities can be in place by fiscal year 2007.

I noticed in your written testimony you talk a great deal about facilities and infrastructure and planning, but I don't see any plan from you or DOE on how those facilities at PNNL are going to be replaced. As owner of PNNL, Mr. Orbach, what are you doing to lead the effort in the Department to seek an aggressive program to replace those facilities at PNNL, which is your laboratory?

Dr. ORBACH. Thank you, Senator, for the question. We are as concerned as you are over the 1,000 staff members who have been so productive for our country. I have visited PNNL often and it is a magnificent laboratory and your assessment of its future is mine as well, and also the community's.

We have put together some funding from our own budget from 2003 and from fiscal year 2004, and there are funds in the fiscal year 2005 budget which we believe can help in this process, but it will require a reprogramming to use the fiscal year 2003 and fiscal

year 2004 funds and so I hope you will help us in the reprogramming request.

Senator MURRAY. So would you support a reprogramming in the fiscal year 2004 budget for that?

Dr. ORBACH. Yes.

Senator MURRAY. You do, okay.

Dr. ORBACH. We may require it for 2003, 2004, and for 2005 we will reassess our options.

Senator DOMENICI. Did you ask him if they had?

Senator MURRAY. I was about to. I will.

Senator DOMENICI. Good.

Senator MURRAY. Had you——

Dr. ORBACH. And I want to say also we're working very closely with the contractor, Battelle, to work together to provide the facilities for the staff who will be displaced from the 300 area. Our target date is October 2007, which as we understand it, would be the latest that the Office of Environmental Management could begin the clean-up in order to satisfy the river corridor agreement that it has by 2012. And we believe that by working with Battelle, we can achieve the facilities that are required to house the staff. They will be new facilities, they will be more efficient facilities, and in the long run we hope that this will be a very positive outcome for the laboratory.

Senator MURRAY. Well, we need to get a reprogramming request from you as soon as possible then to get this going because in order to replace your facility there we're going to have to have some planning in place fairly quickly. And, Mr. Chairman, I really am concerned about DOE's initial inability to coordinate its clean-up and its science programs, and I think we have to be very concerned about DOE's planning process for both the labs and the clean-up sites.

I know that the Secretary's office has become engaged in this matter and I've personally spoken with Mr. McSlarrow and I appreciate the Secretary and Mr. McSlarrow's involvement. I wish it hadn't risen to that level, but I do think we need direction from you, reprogramming requests, and to get this going because 2007 is not that far off when we're talking about an entire facility or large facility there that needs to be—we need to know where we're going with that, so I want to hear more from you on this.

Dr. ORBACH. You're absolutely right, Senator, and I have just met with Dr. Len Peters, the director at PNNL, and we've talked about the need to get moving quickly in order to begin the planning and construction phase. It's my view that if we start now that we can in fact meet that October 2007 date.

Senator MURRAY. When do we expect to see the reprogramming request from you?

Dr. ORBACH. We need to process it through the Department and I'm hopeful that we can get it to you within a month.

Senator MURRAY. All right. Well, Mr. Chairman, thank you very much. I have some other questions. I will submit them for the record and look forward to working with you on this.

Senator DOMENICI. You understand if we get that, unless there's something I'm not aware of, I will hurry up. It comes to me and my friend in the House and we'll try to——

Senator MURRAY. I appreciate that very much.

Senator DOMENICI [continuing]. Try to hurry it up.

Dr. ORBACH. Thank you.

Senator MURRAY. Thank you.

Senator DOMENICI. Senator, would you like to inquire, Senator Craig?

STATEMENT OF SENATOR LARRY CRAIG

Senator CRAIG. Thank you, Mr. Chairman. I apologize for running late.

Senator DOMENICI. I haven't asked any questions yet, but I would like to yield to you for a few remarks.

Senator CRAIG. Well, why don't we move right ahead into the questioning? You proceed with questions and then I'll come to questions. That would be appropriate.

Senator DOMENICI. I was going to make an observation since this was the first time off the Senate floor this year that we have your presence at a committee hearing and I want the record to reflect that we have a very distinguished Senator here. He has a big record. Yesterday he completed work on a bill where he spent more time, took more amendments, defeated more amendments, all in pursuit of the bill that he wanted, that many wanted, only to find that in the end he had to vote against the bill.

Senator, I had been leaving for a little while and taking naps, so when I came in, my staff said, it's very important you be here for the last vote because it's an important thing for your constituency, as you might recall, you were there. And I walked in and made the wrong vote. I voted aye because I had been wanting to help pass that bill. It turned out everything had kind of blown up and you were advising everyone to vote no. How many no votes? Everybody?

Senator CRAIG. Ninety-something, yes. I don't think it was a demonstration of my power whatsoever. I wish it were, Mr. Chairman.

Senator DOMENICI. It was.

Senator CRAIG. But I will tell you, in the words that I've been here working with you and a good many other of our friends, I've learned a few lessons, and I've also learned that something that goes bad does not necessarily get better and that you have an opportunity to stop something and that's what I did yesterday.

Senator DOMENICI. Yes.

Senator CRAIG. Because it had grown worse than we had hoped it would be and because of the rules of the Senate, something those who want to obstruct can obstruct absolutely. We found that on a couple of issues that you and I had been working on in recent times and some of our friends on the other side I think have determined that this is a year of total obstructionism, and so we're going to have to work our way through those problems. Thank you.

Senator DOMENICI. I do want to tell you, Senator, I'm most appreciative of all your work that you've put into the energy bill, and there's a nice story out today that the Minority Leader expects a victory on the floor and so it's just a matter of when. No, there are going to be some Senators like the ones you mentioned that wanted to obstruct that bill, but how many days are they going to get on

it to make our leader frustrated? I don't know. I don't think it's going to frustrate him if they take a few days because he's made up his mind that he wants to send this bill to the House so that the Senate can at least go on record that they've produced one.

SCIENCE PRIORITIES

Having said that, let me move quickly. Dr. Orbach, can you explain to me the department's priorities contained in this 20-year plan and how they were selected? Can you do that very quickly?

Dr. ORBACH. Yes, thank you, Mr. Chairman. We began an initial process in my office through our Associate Directors who headed each of our six programs. That set of recommendations is important because it began first with the research money. We took into account the energy bill authorization level and subtracted from the out-years the cost of doing research. The reason I stress that is that these facilities are not meant to displace our ability to do research. Research comes first. They then provide us the ability to do that.

With the recommendations from the Associate Directors, we went out to our advisory committees, and what you see today reflects the advice, priorities that the advisory committee set with regard to the importance of the science. This is a science-driven prioritization.

I then had over 50 recommendations from the advisory committees and I had to make them fit under the energy bill's authorization levels and I had to make them fit also with regard to time, and when we got done we had 28 facilities that survived.

I was in the unenviable position of having to prioritize across fields, but the response of the community has been very positive and I believe that the scientific community is very supportive of this prioritization.

Z MACHINE APPLICATION TO THE SCIENCE PROGRAM

Senator DOMENICI. Thank you very much. Now let me ask you a question about something technical and see if you can agree to do something for us. Sandia National Laboratory has developed a power plant concept known as the Z machine. You must have heard of it. It has made all kinds of news, including the front page of Time magazine. Shortly after we had agreed to pay for NIF over in California because the Z hadn't quite made it, we got a big announcement that Z was ready to go. What we've got now is about $3 billion invested in NIF and we've got Z going, a little cheap machine.

This machine is the world's most powerful x-ray source, and extensive experiments have led the technology to make breakthroughs that lead to record fusion neutron yields. Although this program has been funded by NNSA, and that's part of the nuclear preparedness program of the country, the low cost and high efficiency seem attractive to the development of commercial fusion power. In fact, this facility has been identified by the Fusion Energy Science Advisory Committee as one of the three promising approaches to internal fusion energy.

I would greatly appreciate it if you would visit Sandia and spend some time with the scientists associated with Z and would be will-

ing to visit the facility. After you've done that and had the opportunity to evaluate it, I would be interested in your thoughts on its application to the science program. Can you do that?

Dr. ORBACH. Yes, Mr. Chairman, I'd be delighted. I've been briefed on the Z-Pinch machine. It is a magnificent accomplishment and I am scheduled to visit Sandia on the 24th of May.

Senator DOMENICI. That's great.

Dr. ORBACH. And I will be spending a good portion of my time there to talk to the people on the Z-Pinch. They have some very clever ideas for renewing it with a liquid wall, which might help in the fusion energy area.

GENOMES TO LIFE PROGRAM

Senator DOMENICI. I have a question with reference to ITER, but I'll just submit that and I'll move on to Genomes to Life. This project focuses on the utilization of genome maps and understanding of genome, or genomic functions in seeking solutions to DOE missions. Funding increases by $4 million to $67 million from its inception. It's accurate to say that the entire program was created by virtue of a discussion which very few people know about which took place in my office with a very distinguished scientist named Charles DeLisi. You may or may not know him but he was with the NIH.

He decided he didn't like the NIH because they didn't like genome research, believe it or not. Think of that. They covet it today as their great baby, but they literally didn't want to do it, so he left and went to the Energy Department. He came to my office and talked me into funding it. Believe it or not, when I got it funded, NIH decided that they should too, so it turned out—you wonder why DOE and NIH are in it, that's why, because I introduced a bill, put it all in DOE, and that brought the people who are for NIH to my office and we changed the bill so they both got funding. Great things happened much quicker than expected in producing the genome mapping of the human system. You're aware of that.

PROTEIN AND MOLECULAR TAGS FACILITY

I note that you plan to start project engineering and design for dedicating a facility, a facility for the production and characterization of protein and molecular tags. I understand that you will conduct a competition for the site of that facility. What's the status of that competition? How will this benefit the Genomes to Life program?

Dr. ORBACH. First of all, Mr. Chairman, I want to thank you for your support——

Senator DOMENICI. You're welcome.

Dr. ORBACH [continuing]. Of genomics and the Genomes to Life program. It has been a tremendous success. What this project does is to take us from the structural elements that we have been able to study through our sequencing to the dynamics of how cells actually function, and this particular factory will produce, as you noted, proteins for our scientists in the United States which are tagged.

We are currently in the final stages of preparing the competition amongst all of the DOE laboratories for the facility, and we are working towards the formal RFP as we speak.

GENOME SCIENCE

Senator DOMENICI. How do you generally, for 2 minutes, think genome is going? The evolution of the genome science, is it going well?

Dr. ORBACH. It's going wonderfully. The relationship with NIH is as you described it. The DOE has the ability to create these large-scale machines using, as you said in your opening remarks, the physical sciences that we have available. This is truly a factory. This will produce proteins that are tagged so there will be a common way of identifying them and visualizing them in cellular function. Your assistance and really initiation of this project has had phenomenal impact.

Senator DOMENICI. You know, it's interesting when people look around and read from time to time some experts tell us, Greenspan testifies and my friend, Senator Craig, gets a hold of it and goes to the floor and gives a speech because Greenspan says productivity went up 8.2 percent and it doesn't bother him because he doesn't have too much hair, but people that have got a lot of hair, they go bald-headed when they hear such a thing. That's incredible.

But I'll give you an example. We produced the entire mapping of the protoplasm of the human genome in half the time predicted when we started the program, half. It was supposed to take 20-plus years, it took 10. Why? Well, because the machines that we used to do it, computers, were never imagined to have the capacity in such a short time that they had. That's a perfect example of productivity. The productivity was incredible in producing the mapping of the human genome, wasn't it? It was so big that it caused us to produce the most complex set of information in half the time, which is the genome mapping of the human body.

I think we haven't even come close to its utility, is that correct?

Dr. ORBACH. Absolutely, and what you've said is true in spades. The sequencing facility we have in Walnut Creek used to cost $2 a base pair to sequence. It now costs two-tenths of a cent, so it's a factor of 1,000 increase in productivity that this factory has achieved. It can now sequence two human genomes a year.

Senator DOMENICI. Entirely?

Dr. ORBACH. Entirely, so that 10 years is now compressed into 6 months.

ADVANCED REACTOR HYDROGEN CODE GENERATION PROJECT

Senator DOMENICI. Just a couple more. This one has to do with Senator Craig and I. Mr. Magwood, general funding under the title of nuclear energy, last year as part of the 2004, $15 million was included in the Generation IV initiative so the Department could begin the research, development, design work on an advanced reactor hydrogen code generation project at Idaho National Laboratory.

Senator Craig and I sent a letter to Secretary Abraham urging him to make a competitive solicitation for this project. The response we received, signed by the Secretary, reassuring Senator Craig and me that the Department intended to undertake this design competition this year. Do you recall that, Senator?

Senator CRAIG. I do.

Senator DOMENICI. Now, can you please tell us what you have prepared for the budget and the schedule for this solicitation, and what you believe your funding requirements will be for 2005? Are the funds requested sufficient to support the engineering design of at least two competing concepts as spelled out in H.R. 6 prior to selecting the final choice?

Mr. MAGWOOD. Mr. Chairman, we have been working very hard over the last several months since the 2004 appropriation was passed to put in place the kind of program that you're describing. We do expect to have some sort of solicitation available for the industry and others to look at this fiscal year, fiscal year 2004, and we believe that the funding that we have available in fiscal 2004, and what we have requested in fiscal 2005, which by the way is an increase for this activity of about $4½ million over the 2004 request, 2004 appropriation rather, is sufficient to move forward.

Obviously, if we move forward with a major project, significantly more funds will be needed, but at this stage of the game, we believe that what we've asked for is enough.

WORLD NUCLEAR POWER PLANTS UNDER CONSTRUCTION ON ORDER

Senator DOMENICI. I have two other questions for you, Mr. Magwood, and then I'll proceed to yield to Senator Craig. One, could you get for us at your earliest convenience a current status of the construction of nuclear power plants in the world? Get us a report that says as of this date, whatever date that is, three plants are being built in Taiwan, two in China, one somewhere else, so we would know just how many plants the world is building, and if you can, tell us what their status is and what kind they are, we'd appreciate it.

Mr. MAGWOOD. Be happy to do that.

[The information follows:]

WORLD NUCLEAR POWER PLANTS UNDER CONSTRUCTION AS OF JANUARY 1, 2004

Country	Name	Location	Type [1]	Capacity (MWe)	Year of Expected Commercial Operation [2]	Comments
USA	Browns Ferry 1	Decatur, AL	BWR	1,065	2007	Approximately $1.7 billion is being invested over five years to return this unit, which has not operated since 1985, to service.
Argentina	Atucha 2	Buenos Aires	PHWR	962	NA	Suspended indefinitely.
China	Tianwan 1	Jiangsu	VVER	1,000	2004	
China	Tianwan 2	Jiangsu	VVER	1,000	2005	
China—Taiwan	Lungmen 1	Taipei	BWR	1,300	2006	
China—Taiwan	Lungmen 2	Taipei	BWR	1,300	2007	
India	Kaiga 3	Karnataka	PHWR	202	2007	
India	Kaiga 4	Karnataka	PHWR	202	2007	
India	Kudankulam 1	Tamil Nadu	VVER	917	2007	
India	Kudankulam 2	Tamil Nadu	VVER	917	2008	
India	Rajasthan 5	Rajasthan	PHWR	202	2007	
India	Rajasthan 6	Rajasthan	PHWR	202	2008	
India	Tarapur 3	Maharastra	PHWR	490	2007	
India	Tarapur 4	Maharastra	PHWR	490	2006	
Iran	Bushehr 1	Bushehr	PWR	915	2005	
Japan	Hamaoka 5	Shizuoka	BWR	1,325	2005	
Japan	Higashidori 1	Aomori	BWR	1,067	2005	
Japan	Shika 2	Ishikawa	BWR	1,304	2006	
North Korea	LWR–Project 1	Kumho	PWR	1,040	NA	Construction suspended pending a decision, to be made before 12/1/04, on whether support for this project by the Korean Peninsula Energy Development Organization (KEDO) should continue.
Romania	Cernavoda 2	Cernavoda	PHWR	655	2007	
Russia	Balakovo 5	Saratov	VVER	950	2008	
Russia	Kalinin 3	Tver	VVER	950	2004	
Russia	Kursk 5	Kursk	RBMK	925	2006	
Russia	Rostov 2	Rostov	VVER	950	2007	
South Korea	Ulchin 5	Ulchin	PWR	950	2004	
South Korea	Ulchin 6	Ulchin	PWR	950	2005	

Ukraine	Khmelnitski 2	Neteshin	VVER	950	2004	
Ukraine	Rovno 4	Kuznetsovsk	VVER	950	2004	
Total				24,130		

[1] BWR–Boiling Water Reactor; PWR–Pressurized Water Reactor; PHWR–Pressurized Heavy Water Reactor; LMFBR–Liquid Metal Fast Breeder Reactor; VVER–Soviet-designed PWR; RBMK–Soviet-designed boiling water, graphite-moderated, pressure-tube reactor.

[2] NA–Not Announced.

Sources: IAEA Power Reactor Information System; Uranium Information Centre/World Nuclear Association; Nuclear News 2004; organization press releases/web pages.

WORLD NUCLEAR POWER PLANTS ON ORDER AS OF JANUARY 1, 2004

Country	Name	Type [1]	Capacity (MWe)	Year of Expected Commercial Operation [2]
China	Lingdong 1	PWR	1,000	2012
China	Lingdong 2	PWR	1,000	2012
China	Sanmen 1	PWR	1,000	2012
China	Sanmen 2	PWR	1,000	2012
Finland	Olkiluoto	PWR	1,600	2009
India	Kaiga 5	PHWR	489	NA
India	Kaiga 6	PHWR	490	NA
India	Rawatbhata 7	PHWR	490	NA
India	Rawatbhata 8	PHWR	491	NA
Japan	Fuikishima 7	PWR	1,325	2009
Japan	Tomari 3	PWR	912	2009
Japan	Fuikishima 8	PWR	1,325	2010
Japan	Higashidori 1–2	BWR	1,320	2011
Japan	Shimane 3	BWR	1,375	2011
Japan	Tsuruga 3	PWR	1,500	2011
Japan	Higashidori 2	BWR	1,320	2012
Japan	Ohma	BWR	1,350	2012
Japan	Tsuruga 4	PWR	1,500	2012
Pakistan	Chashma 2	PWR	300	2011
South Korea	Shin Kori 1	PWR	950	2008
South Korea	Shin Kori 2	PWR	950	2009
South Korea	Shin Wolsong 5	PWR	950	2009
South Korea	Shin Kori 3	PWR	1,350	2010
South Korea	Shin Wolsong 6	PWR	950	2010
South Korea	Shin Kori 4	PWR	1,350	2011
South Korea	Ulchin	PWR	1,350	2015
South Korea	Ulchin	PWR	1,350	2015
Total			28,987	

[1] BWR–Boiling Water Reactor; PWR–Pressurized Water Reactor; PHWR–Pressurized Heavy Water Reactor.
[2] Not Announced.

Source: Uranium Information Centre/World Nuclear Association.

ADVANCED FUEL CYCLE INITIATIVE

Senator DOMENICI. You know, Mr. Magwood, some of us in this Congress are very happy that the President and the Secretary have finally come around. They're talking about trying to stop proliferation of Weapons of Mass Destruction in the broadest sense, stop the proliferation of the great scientists, you know about that. We're trying to stop the flow of plutonium, got a big program going, highly enriched uranium, we've bought a bunch of it from them, a lot of things, cost a lot of money, but we've started.

Now, I am very concerned. With that going and the threat of nuclear proliferation, what's the basis for reducing funding for this account, Advanced Fuel Cycle Initiative, from $66 million to $46 million? Would you update the committee as to what you hope to achieve this year, when you expect to have a project ready for deployment?

Mr. MAGWOOD. Yes, Mr. Chairman. First, I should say that the Advanced Fuel Cycle Initiative really has shown tremendous progress over the last several years and continues to show progress. For example, we have successfully demonstrated on a laboratory scale the separation of pure uranium from spent fuel, to the point of 99.999 percent purity.

We've also demonstrated on a laboratory scale the separation of a mixed neptunium/plutonium fuel that we believe could form the basis of a new proliferation-resistant recyclable fuel for the future, and this work is going to continue in increasing scale in fiscal 2005.

So our primary missions for this program will continue. We will continue to make progress. The reduction that you spoke of is primarily because we are deferring the project of a large commercial-scale facility for UREX+ until we've gained greater confidence that this technology is really viable commercially.

That said, there are—we are going to continue to fund our primary missions for the program. That will continue.

Senator DOMENICI. Senator Craig.

Senator CRAIG. Mr. Chairman, thank you very much. Let me use my time both to ask questions and make in positioning those questions somewhat of an opening statement, and I'll address my questions at you, Bill, and I do thank all the rest of you for being here.

ADVANCEMENT OF NUCLEAR ENERGY TECHNOLOGY

Bill, your prepared statement starts off by talking about the times not so many years ago when this country was very close to abandoning advanced nuclear reactor research and development. I remember those years very well. As a matter of fact, the chairman and I wrote a letter to the then-Secretary of Energy, Federico Peña, and we told him this in our letter, and I'm going to quote from that letter, that was 1997.

The Chairman and I said, the coming fiscal year will mark a notable event in the history of your agency and its predecessors. For the first time since the establishment of the Atomic Energy Commission more than 40 years ago, the United States Government has no program to further the development of nuclear energy for the production of energy. This change, in the view of many, of the technology's critics is long overdue. However, in the view of many members of the Senate and in the view of the Nation's energy experts, the lack of a strong and reliant nuclear energy research and development program represents a major gap in the Department of Energy's research and development agenda.

The year is now 2004. We've traveled a long way on nuclear energy since I signed that letter along with the chairman. I appreciate your efforts in the progress we've made and I mean that most sincerely, but I must suggest to you that the state of our nuclear energy program is nearly as fragile and vulnerable today as it was when we sent that letter in 1997, and I will further suggest that the nuclear energy budget proposal for fiscal year 1995 is as—is a—2005—is a discredit to the progress that we've made. I believe the chairman has made similar strong statements.

INEEL SOLICITATION AND INFRASTRUCTURE

That's the basis of my following questions, the question that the chairman just asked was my first question, and I appreciate him asking it. So, having heard that answer, Bill, let me ask you this question. Since you will be issuing a solicitation, why have you not engaged the experts at the Idaho labs, the INEEL and Argonne, that are supposedly DOE's command center of nuclear R&D? To

my knowledge, you have not engaged anyone in the lab in this initiative yet. Is that true?

Mr. MAGWOOD. In the actual solicitation?

Senator CRAIG. In the process.

Mr. MAGWOOD. In the process, not yet, and that's because we are still working within my office to put a plan on the table where we can sit down with those lab scientists and discuss the ins and outs and the particulars of it. It's been my experience that before sitting down with the scientists who are trying to deal with very technical issues, it's been my job to set the framework as to how to accomplish a particular mission, and that's proven successful in the past and that's what we're implementing this time.

Senator CRAIG. Well, I thank you for that, because the Office of Nuclear Energy is currently responsible, I think is the lead program office for the INEEL. Because you have this lead, most of the costs for supporting the INEEL's infrastructure being transferred over to the nuclear energy budget, my conclusion is that the nuclear energy budget is not growing sufficiently to support the infrastructure that your program is becoming responsible for at Idaho.

I think this leads to a very dangerous situation. You can either not support the infrastructure adequately, a program that some would say already exists, or you can raid your small research budget to support the infrastructure. Over time, the nuclear energy program might reach a point where it is doing very little research but is merely supporting an aging infrastructure. Either way, it is a bad situation for nuclear energy, for Idaho, and for the country from my perspective.

We even had a recent example, I think, with the Advanced Test Reactor, the only operating test reactor in Idaho and one of the few in the DOE complex. What happened? It was shut down because the safety documentation was not up to date. Lack of resources, lack of initiative, down goes the reactor. Question: Do you believe the budget you are requesting is sufficient to fully support the Idaho infrastructure as well as research you are charged with doing?

Mr. MAGWOOD. Senator, I would say that clearly—you use the word fragile—and I clearly agree with that. I think that the program is at a fragile state at this point in history, but nevertheless, still poised for some considerable growth. In the case of the infrastructure and research program that we've laid out for fiscal 2005, I do believe that it's sufficient to meet the primary missions that we've set out for ourselves.

We have a long way to go to build this laboratory. It's going to be a long, hard process that we think will take 10 years to really accomplish. So while this fiscal year 2005 budget request is a first step, a fragile first step, it is only the first step, and I think that what we do in fiscal years 2006 and beyond will probably be more important to the future of the laboratory than what we've done in 2005.

Senator CRAIG. Well, I guess my greatest concern, one last comment——

Senator DOMENICI. Sure.

Senator CRAIG [continuing]. Mr. Chairman, it is that tearing down and then building back can be a very expensive process, one

that I doubt this country could afford to do or would be willing to do. Sustaining and building on a sustained base is something that we can afford to do and should.

Now finally, I have many concerns, I think, with DOE's request for the proposals for the Idaho lab. This is not, I think, the forum to explore all of those concerns, but let me say this. The Idaho congressional delegation will be sitting down with the Secretary. We are very concerned about DOE's draft RFP. It does not reflect, we believe, the principles necessary to build a sustainable new mission. We—and I say this, Mr. Chairman—I know that Los Alamos is facing a recompetition in its operating contract in the near term.

Senator DOMENICI. Yes.

Senator CRAIG. I think that we have at stake some very important issues to address with DOE as we craft RFP's for the sustainability and growth of these laboratories. So I say that as now not just an observer, but one who's fully engaged in an RFP that—the devil is in the details, and we're very much focused on the details.

I thank you very much, Bill, to all of you thank you much. Mr. Chairman, thank you.

ENERGY EFFICIENCY PROGRAM DIRECTION

Senator DOMENICI. Mr. Garman, did we fail to ask you something that is important in your opinion that you want put on the record?

Mr. GARMAN. I would like to mention one thing, Mr. Chairman.

Senator DOMENICI. Please do.

Mr. GARMAN. And I appreciate the opportunity. You said something a little earlier about gaining control of the program and understanding and being able to be accountable for the things we spend——

Senator DOMENICI. Yes.

Mr. GARMAN [continuing]. And to assure the taxpayers are receiving value for their dollars. I think the committee will note that we have sought an increase in funding for program direction, which is not a very popular thing to do and a very difficult thing to talk OMB, much less the Congress, into doing.

But we've done that and we were successful in making our case to OMB and we think it's important, because quite frankly, we heard what you said in your direction to us in prior conference reports that we must have an increased vigilance in project management and that we take project management very, very seriously. And candidly, in the past we ceded some of our responsibilities to contractors and others that we need to re-federalize to ensure that we're doing a good job. More money will actually get to the lab at the bench doing R&D, which is the important thing, and so I do leave you with that plea and thank you for that opportunity.

Senator DOMENICI. Well, thank you. Thank you to all three of you and for the record, I'd like to close with two things. First, it's my understanding that Senator Stevens from Alaska has questions he's going to ask of you. They're going to be submitted. Please answer them as quickly as you can. I ask that any other questions submitted to you by me or any other members of the committee receive your response within 2 weeks, and again, I said if you can't do it, tell us so we don't sit over here getting mad at you for not

doing your work. The record will be left open for 2 weeks for members to submit questions, so watch for them also.

YUCCA MOUNTAIN

Senator Craig, I would just like to talk with you a moment about the status of nuclear power in the world and what a terrible mistake the United States has made, is making. You know, there is nobody, no country trying to build a Yucca facility, just America. France has 87 percent of its facility from nuclear. Countries have lots of nuclear power. So I ask for the record for conversation, that we be able to talk about what's even happening today, how many new reactors are being built.

Senator CRAIG. Good point.

Senator DOMENICI. Lots of them. I don't mean 50, but I can check off six or eight that I know about. What are we doing? Nothing. Every year we have a fight over how much is enough for Yucca and we all with bated breath wonder, is the Nuclear Regulatory Commission (NRC) going to really license them, aren't they?

And if you go to Europe or France and you'd say, I'd like to see your spent fuel rods. Oh, fine, we'll take you. They put you in a bus and blindfold you—no they don't, but they could—and say, we're here and let you out. You walk into this beautiful building, looks like a great schoolhouse, modern schoolhouse, and once you're in the doors, they say, now you can look all around. And you look around and you say, this is where all the nuclear waste is, and you say, well, what are you talking about. Well, now you can just look down and you look down and it's all in the floor in casks, glass casks. Spent fuel rods are in there and the whole thing is filled with glass of some kind and you walk all over the place and there's no radioactivity escaping, it never will, and they may take it out of there in 100 years. They plan to get it out in 50 but they're wondering how crazy, why do we want to do that and just disturb everybody. It's very safe.

Here we sit with the tail end of this tiger haunting us, the greatest engineers in the world. This morning we read we're following old Rover around up there on the red planet, right? Trying to find out how much water was up there, how many thousands of years ago, and America can't find a way to dispose of in a safe manner high-level waste so you can build some nuclear reactors.

To me, one of the most astounding failures on the part of talent and leadership that the world has ever seen, and we're all worried about energy. Now we're going to run out of the next one, which is natural gas. We've already run out of crude oil, now pretty soon natural gas, and then pretty soon after that, who knows? But we've got 15 big power plants in a row waiting there, where's my natural gas, right, 15, I think, or 13, up almost 1,000 kilowatts each. Not a single one plans to use coal, geothermal, nothing, all natural gas.

Well, to me, we have a little bit of a role up here when we're in the Senate for a while, we're only here a few years. But I tell you, I'm going to continue to make the point and try to make the proposition wherever I can that the United States must get on with this, and frankly I wouldn't be at all adverse right now, as late as it is, to pick a site for interim storage and do it. You know, Senator, we've come that close.

Senator CRAIG. Oh, yes.

Senator DOMENICI. If we didn't have the President we had at that point, we would already be building interim storage some place and it wouldn't have been the least bit dangerous to anybody except those who want to run around and claim that the world's dying because there's radioactivity coming out of spent fuel. So obviously you can't help but get my lecture.

Senator CRAIG. Well, Mr. Chairman, for those of us who worry about a variety of issues when it comes to energy, I so totally agree with you that we've not only made some missteps and some poor judgement over time because of the political pressures involved, but we've been unwilling to lead.

The reason I was late coming here, as I was sitting down with the new Minister for Energy from Canada. Canada loves us at the moment and they'll continue to love us more because we're not developing energy and they are and they're anxious to send it south. And I'm glad they're our northern neighbors, because if we cannot rely on ourselves, thank goodness we've got them to rely on.

But the consequence of doing that is that the $35 billion that flows north today will be $40, then $50, then $60, then $80, then $100 billion a year and more, and that's not good business that some of that can't stay here. That'll be our companies north of the border working with Canadians and Canadian companies.

CLIMATE CHANGE

But lastly, I found it fascinating, I was in Milan this winter for the climate change conference. The world has significantly changed since I was in Belgium a few years ago where I was almost—put it this way—a riot almost occurred, we almost were succumbed by eggs and pies in the face and all of that. Today the world recognizes a folly so defined. The Minister of Energy for Italy, now that Italy has ratified the Kyoto Protocol, suggests that they can't meet it. In fact, their gases today, emissions, are a factor of 5, 4 or 5 percent higher than they were at the time. You cannot grow today in the world using hydrocarbons without greater emissions and nobody wants to die, economically speaking.

I met with the Minister of Environment for Japan. Japan was at 6 percent above 1999 gas emissions at the time they signed it. They are now 13 percent and she opined as to how they could not meet, and they've even become an aggressive nuclear reactor developer.

So it is significant out there that politics sometimes mislead us dramatically, but the reality is that those emissions levels cannot be met, because we're driving the world toward greater use of hydrocarbon, and unless we advance the technologies of their utilization, we don't meet anywhere near those standards unless we just turn our economy off.

Lastly, we met the 1999 standards about 6 months ago, 8 months ago in this country, and the reason we did was because we were in a recession and we reduced our employment by 2.5, almost 3 million jobs, and we met the standard or were right at it. That's the bad news, so you see they can be met, and for those of us who went to the floor and spoke of those realities, guess what? We were right. I don't like to be right on those kinds of issues, but we were.

Now, the good news is that we come back—as we come back online, and we are, our unit of utilization of hydrocarbons is less per unit of production. Our emissions are less per unit of production coming back online because the technologies we are applying are newer. We're not using less hydrocarbon, we're using it differently, and those of us who have advocated technology and the application of technology over the years again are right as it relates to economic growth development and jobs.

And the combination of the two, and that's what the chairman has always driven toward, the development of hydrocarbons and the combination of nuclear energy, is the right combination. So we're not going to give up on this fight. I hope the chairman is right that the Minority Leader will support us in the policy you've developed. Our new hurdle will be the House again and we'll work closely over there to see if we can't get something accomplished this year, but thank you for your leadership, Mr. Chairman. It's greatly appreciated.

ADDITIONAL COMMITTEE QUESTIONS

Senator DOMENICI. Thank you very much, Senator. I just want to say, what one should do as you listened to all statements just made by the good Senator from Idaho, we probably ought to conclude our remarks by saying we speak of nuclear because it has not contributed any of the pollutants we're worried about, zero. So it's not like we were for it because we did it once and it's our baby. It's because the pollutants that we're worried about and the pollutants that are going to ruin China come from coal, come from those kinds of products which they're going to all have to produce because everybody's scared of nuclear. Nuclear produces none excepting fear and trauma from those who are scared and question what we do with the waste.

[The following questions were not asked at the hearing, but were submitted to the Department for response subsequent to the hearing:]

QUESTIONS SUBMITTED BY SENATOR PETE V. DOMENICI

TWENTY YEAR FACILITY PLAN

Question. Given the strong support demonstrated by the Secretary for your 20 year facility plan can you help me understand how this budget supports these new priorities?

Answer. The 20-year facility plan is not a budget document and reflects a most aggressive and optimistic view of future funding for the Office of Science. Affordability of these facilities will depend upon many factors in the future, and the list of facilities may change as science priorities evolve and mature. In the fiscal year 2005 request, funding is provided for the top 5 facility priorities in the plan as follows: ITER $7,000,000; Ultrascale Scientific Computing capability $38,212,000; Joint Dark Energy mission $7,580,000; Linac Coherent Light Source $54,075,000; and Protein Production and Tags $5,000,000. We consider the above facilities to be near-term priorities for the next decade.

INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)

Question. Can you explain why the Department purposefully ignored congressional direction in this regard?

Answer. We believe the Department has not ignored Congressional direction because the fiscal year 2005 budget request does not reduce the overall level of domestic fusion research to any significant extent as a result of ITER preparations. Where appropriate, domestic fusion experimental, theoretical and enabling technology re-

search is reoriented more toward the needs of ITER. This research is performed by existing fusion scientists and engineers. Only a very small amount, on the order of $1 million of the ITER preparations request of $38 million, is for industrial preparations at this time. This reorientation of fusion research has resulted in some shifts in priorities, such as reducing facility operating time and focusing technology more on the near-term, but overall the domestic fusion research is not reduced to any significant extent.

Question. Can you please update the subcommittee on the ongoing negotiations to pick a location for the project?

Answer. The ongoing negotiations are centered on the two host candidates, Japan and EU. These two governments are communicating with each other and trying to find a solution. On the periphery, all of the negotiating parties are still discussing various technical aspects of the two candidate sites; however, this is not likely to be decisive as both sites are considered to be fully acceptable.

Question. What does the funding curve look like for this large international project?

Answer. Assuming the site negotiations are successful and the ITER International Agreement is completed, fiscal year 2006 would be the earliest time to start the ITER construction project. According to a preliminary cost and schedule estimate—which has yet to be validated according to the project management guidelines for capital assets set out in DOE Order 413.3 and OMB Circular A–11—the profile of the U.S. funding share would begin in fiscal year 2006, peak around fiscal year 2010 at about $190 million, and end in fiscal year 2013.

Question. How much funding is the United States expected to provide on an annual basis going forward and how does that compare with our international partners on this project?

Answer. The U.S. contributions to the project, mainly in the form of hardware, but also including some personnel to work on the project and some cash for common expenses, would be about 10 percent of that required for the total project. That is essentially the same as all of the non-host partners.

WHO CONTROLS THE HYDROGEN INITIATIVE?

Question. Who is ultimately responsible for the overall hydrogen initiative, and what controls will be implemented to ensure the taxpayers are getting best deal for the research dollars?

Answer. Within the Department of Energy, the Offices of Energy Efficiency and Renewable Energy (EE), Fossil Energy (FE), Nuclear Energy, Science and Technology (NE), and Science (SC) participate in the hydrogen initiative. As stated in the DOE Hydrogen Posture Plan, the Office of Energy Efficiency and Renewable Energy leads the effort and is responsible and accountable for DOE's success or failure in carrying out the Plan.

The Hydrogen Posture Plan includes performance-based milestones that will be used to track progress of the hydrogen initiative. Based on a recommendation by the National Academies, the Hydrogen, Fuel Cells, and Infrastructure Technologies Program is establishing an independent systems-analysis activity to help prioritize research, evaluate program risks, and ensure that results meet requirements. The Program will undergo periodic peer reviews of its plans and research such as the one just recently performed by the National Academies.

The approach of the Department's four offices working together has been to:

—Update internal planning documents annually to support the administration's request for the President's Hydrogen Initiative;

—Ensure EE, FE, NE and SC budget submissions to OMB support the DOE Posture Plan and that there are no gaps or redundancies in requested budgets;

—Plan solicitations and evaluate proposals; and

—Evaluate funded research.

No conflicts have arisen between the four DOE offices participating in the hydrogen initiative thus far. Should conflicts arise in the future, the Under Secretary for Energy, Science and the Environment will ensure program and budget integration, as all of the Assistant Secretaries and Directors of the four offices involved in the effort at DOE report to the Under Secretary.

The Department also works closely with the Department of Transportation, which currently has a small role, but whose participation will grow more important as hydrogen technologies advance toward commercialization.

R&D VS. FUNDING FOR DEMONSTRATION PROJECTS

Question. How is DOE deciding on and managing the balance between funding for the necessary research for the required breakthroughs and funding for demonstration projects using current technology platforms?

Answer. A continuum of research and development, from basic science to demonstration, will be needed to develop a long-term hydrogen economy.

Basic science will be performed in areas that are only conceptual but have the potential for making major impacts. An example would be photoelectrochemical production of hydrogen (direct solar conversion without the intermediate step of electrolysis). Although conversion efficiencies are orders of magnitude too low, the potential benefit is great because of the large renewable resource available. This research may take decades to come to fruition.

Exploratory and applied research will be done in areas where there is proven performance but a large gap still exists between current technology and what is needed to meet consumer requirements. An example is hydrogen storage, where approaches such as metal hydrides are proven, but we still need improvement factors of two to three times current values to meet our requirements. As performance improvements are made, cost targets become more important.

Demonstrations are appropriate when technology has matured to the point that system integration issues must be addressed and performance under real-world operating conditions must be evaluated. Further research or significant progress may still be needed to reduce cost, but system performance must be validated. Demonstrations may uncover operating issues not previously considered, such as performance in certain climates, and will guide and refocus future R&D efforts.

The National Academies' hydrogen report recommended that the Department shift away from some development areas towards more exploratory work. Exploratory research involves the application of novel ideas and new approaches to "established" research topics, and is likely to catalyze more rapid advances than basic research and more innovative advances than applied research. The Department is doing this through the Hydrogen Storage Grand Challenge, which includes the establishment of three "Centers of Excellence" led by national laboratories along with multiple university and industry partners. This could be a model for "expert" centers focusing on other priority research areas.

CENTERS FOR EXCELLENCE IN HYDROGEN

Question. How do you plan to fund your soon-to-be announced centers for excellence in hydrogen storage, and future R&D efforts?

Answer. Funding for the Hydrogen Storage Grand Challenge solicitation was requested in the fiscal year 2004 budget. However, due to the number of and funding associated with Congressionally-directed projects in the fiscal year 2004 hydrogen account, no funds are available to start the Centers of Excellence and other projects selected under the Grand Challenge this year. These efforts will be initiated in fiscal year 2005 with fiscal year 2005 funds, subject to the availability of funds.

STORAGE CENTERS

Question. Will you start any activity this year for these storage centers to begin the important groundwork?

Answer. No. Due to the number of and funding associated with Congressionally-directed projects in the fiscal year 2004 hydrogen account, no funds are available to start research in the Centers of Excellence and other projects selected under the Grand Challenge this year.

OMB FUNDING REQUEST

Question. Your [EE] budget has an unusually large funding increase for Program Funding within the Renewable section. Funding increased by 67 percent from $12.3 million in fiscal year 2004 to $20.7 million. How did you get this funding request by OMB and how do you intend to use the funding?

Answer. Of the proposed $8.4 million increase, $3 million is for a new activity, the Climate Change Technology Program (CCTP). These funds will generally be used for support services in developing a CCTP strategic plan and conducting analyses.

Excluding this new activity, the increase we request is $5.4 million, or 44 percent. Much of this proposed increase is in direct response to the committee's exhortations that EERE emphasize better stewardship through stronger project management and increased competition in contracting.

We plan to spend $3.6 million to hire additional Federal staff in order to move away from the practice of using the laboratories to oversee their own contracts, cooperative agreements, and grants. We believe these inherently Federal activities should be performed by Federal employees. Our fiscal year 2005 budget request includes an increase of 22 FTE over the budgeted level of 84 FTE for fiscal year 2004, mostly for project management staff at the Golden Field Office.

It is important to note that hiring Federal staff instead of using laboratory personnel for these 22 FTEs will allow more of EERE's funding to be devoted to actual R&D activities. In fact, we calculate that filling these 22 FTE positions using laboratory personnel would cost roughly $5.8 million, compared to $3.6 million for Federal staff. This action will therefore "save" an estimated $2.2 million in program funding, which is captured in the Program Direction budget line. We do not show the "savings" by program in the budget justification materials because program budgets generally do not include a line item corresponding to overhead costs for laboratory staff to manage contracts. These costs are built into each budgetary line as appropriate. The entire amount of the "savings" within each program is redirected from formerly unstated program overhead costs to actual program activities that contribute to program goals.

Of the remaining portion of the increase ($1.8 million), $1.2 million will be used to sustain the current on-board staff level of 84 FTE. The remaining $0.6 million will be used mostly for support services, information technology investments, consolidation of legacy business practices and systems, and management services for implementing our strategic management system.

NUCLEAR ENERGY BUDGET

Question. Based on this anemic budget should the committee assume that the nuclear energy is no longer a priority for this administration?

Answer. The President's budget request increases the funding for the Department's nuclear energy program by 1.2 percent to about $410 million for fiscal year 2005. This budget advances the policy direction for the Nation's energy security established by the National Energy Policy and allows the Department's priority efforts in programs such as Generation IV and the Nuclear Hydrogen Initiative to proceed vigorously. The Department's request more than doubles the fiscal year 2004 request for each of these programs, demonstrating the administration's commitment to dealing with not just the short-term issues of the energy market, but longer-term, strategic issues.

In addition, the President's fiscal year 2005 budget also lays the groundwork for one very important element of the administration's effort to expand our future use of nuclear energy with the creation of a new national laboratory, the Idaho National Laboratory. This new laboratory's central mission is to pursue research, development, demonstration and education associated with nuclear energy.

Two of the Department's nuclear R&D programs have ended with the fiscal year 2005 budget.

—We request no funding for the Nuclear Energy Research Initiative (NERI) for fiscal year 2005, but the activity will continue as an annual competitive research grants program for university researchers that is tied to mainline programs such as Generation IV and Nuclear Hydrogen Initiative. We believe that, to be relevant, the NERI program must be tied more closely to the Department's mainline nuclear energy programs. We also believe that NERI's greatest benefit is in its support for the Nation's university nuclear technology programs. The restructuring of NERI addresses both of these important concerns.

—The Nuclear Energy Plant Optimization program has accomplished the most important mission it was designed for: addressing many of the aging material and generation optimization issued which have been identified as the key long-term issues facing current operating plants. We are confident that industry will continue supporting the research objectives highlighted by NEPO because these objectives are consistent with industry's interest in the long-term, reliable, and economic operation of existing nuclear power plants.

We are requesting less for two other programs:

—The Advanced Fuel Cycle Initiative requires less funding in fiscal year 2005 because the Department has decided against the rapid development of commercial-scale UREX+ technology. Instead, we are focusing on longer-term, higher-payoff research at laboratory scale in next-generation fuel cycle technologies including advanced aqueous and pyroprocessing spent fuel treatment, advanced transmutation and Generation IV fuels, and detailed systems analysis and modeling.

—The Department has requested only minimal funding for the Nuclear Power 2010 program in fiscal year 2005 to enable the continuation of ongoing licensing demonstration and related analysis projects. Future requirements for the program will be reviewed as Congress completes work on comprehensive energy legislation and the Department assess the responses and requirements associated with its recent solicitation related to New Plant Licensing Demonstration Projects.

NUCLEAR ENERGY TECHNOLOGIES/NUCLEAR POWER 2010

Question. Can you please update me on the status of the Nuclear Power 2010 program and explain to me how this money will be used and how it will benefit the companies participating in this program?

Answer. The Nuclear Power 2010 program is a joint government/industry cost-shared effort to identify sites for new nuclear power plants, develop advanced nuclear plant technologies, evaluate the business case for building new nuclear power plants, and demonstrate untested regulatory processes. These efforts are designed to pave the way for an industry decision by the end of 2005 to order a new nuclear power plant which will be built and begin commercial operation early in the next decade.

As an initial step in the demonstration of the untested regulatory processes, the Department has established cost-shared cooperative projects with three nuclear power generating companies to demonstrate the Nuclear Regulatory Commission (NRC) Early Site Permit (ESP) licensing process. Under these cooperative projects, each of the three power generation companies (Dominion, Exelon, and Entergy) prepared and submitted, in the fall of 2003, an ESP application to the NRC. The program will support the analysis and regulatory interactions required to allow the NRC to issue Early Site Permits to all three sites during fiscal year 2006.

In fiscal year 2003, the Department initiated a cost-shared project with an additional power company, Tennessee Valley Authority (TVA), to evaluate the environmental, seismic and geo-technical suitability of a commercial nuclear plant site in Alabama. This project is expected to be completed in October 2004 and will provide important input for a TVA decision to proceed with ordering and building a new nuclear power plant.

The remaining critical untested regulatory process is the combined Construction and Operating License (COL) process. The COL process is a "one-step licensing" process which results in resolution of all health and safety issues associated with construction and operation of a new nuclear power plant. The importance of this new "one-step licensing" process is that all regulatory and licensing issues are resolved before a power company makes a major investment and begins construction of the plant. In fiscal year 2003, the Department initiated a cost-shared project with industry to develop generic guidance for the COL application preparation and to resolve generic COL regulatory process issues. This project will be completed in fiscal year 2005.

In November 2003, the Department solicited power company proposals to initiate New Nuclear Plant Licensing Demonstration Projects. Under these cost-shared projects, power companies will conduct the necessary activities to select an advanced reactor technology and prepare a license application to build and operate a new nuclear power plant. These projects will also provide for NRC design certification of a standardized nuclear power plant design. The Department expects to receive two or three and proposals from industry teams.

This work and a variety of smaller studies in cooperation with a range of industry partners will advance the public/private effort aimed at the deployment of new nuclear power plants around the beginning of the next decade.

Question. Do you have an estimate as to how much time the DOE proposed contribution of $10 million will save companies in this licensing process?

Answer. The Nuclear Power 2010 cooperative licensing demonstration projects with the power generation companies has made it possible for the companies to seek Early Site Permits (ESPs) and begin planning for a combined Construction and Operating License (COL). Successful demonstration of the licensing processes will encourage future decisions to build new nuclear plants by elimination of industry concerns over regulatory risk and reduction in the overall license process duration. It is estimated an overall reduction of at least 1 year in the ESP licensing application and approval process can be realized from the current projection of 4¼ years. Similar time savings is expected to be realized in the COL licensing process. The savings for COL applicants are in addition to more than 2 years in savings projected to be realized as a result of having certified standardized Generation III+ designs available.

Perhaps more important than the funding provided to support this work is the Department's partnership with the industry in exploring the development of new nuclear power plant projects. Without such aggressive government support, which flows from the National Energy Policy and public encouragement provided by senior administration officials, it is possible that industry would be more hesitant to pursue these activities.

Question. Do you have an estimate as to what you believe the companies will expend over the next year?

Answer. As part of the Nuclear Power 2010 program cost-shared projects, power companies are expected to invest an amount at least equal to DOE spending. For ongoing activities in fiscal year 2005, industry is expected to spend at least $4.5 million on the Early Site Permit Demonstration projects and an additional $1.8 million for generic activities and guidance development for COL applications.

The Department expects to have a firm estimate of industry planned expenditures for fiscal year 2005 and the overall requirement for the licensing and development of Generation III+ designs after assessing the industry responses to its recent solicitation for New Nuclear Plant Licensing Demonstration projects. This solicitation was issued in November 2003 and we expect to receive responses from industry in spring 2004. The most recent industry estimates provided to the Department project an industry cost-share of approximately $60 million to $80 million per year through 2010 to obtain a combined Construction and Operating License and complete associated first of a kind engineering activities.

IDAHO NATIONAL LABORATORY

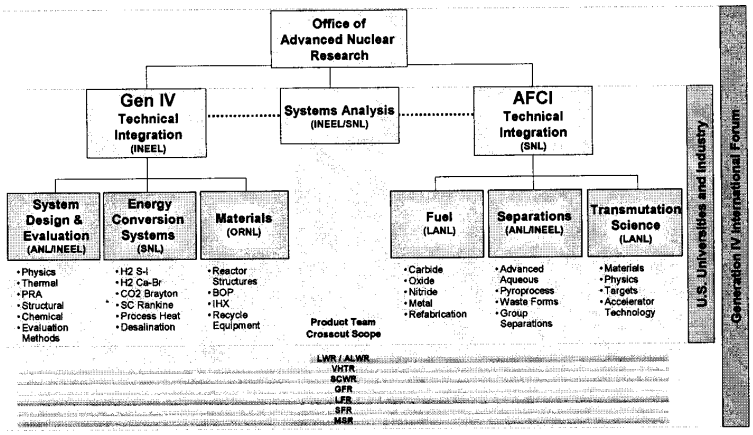
Question. Following the establishment of the Idaho National Laboratory, what role do you see for the other laboratories that currently contribute to the nuclear energy program?

Answer. We anticipate that several of the Department's national laboratories will continue to play key roles in implementing the Office of Nuclear Energy Science and Technology's research and development agenda. While the Idaho National Laboratory will develop a prominent and central role in the nuclear energy technology program, the expertise and capabilities of several other labs—chiefly Oak Ridge National Laboratory and Los Alamos National Laboratory—will be essential in the success of our research efforts.

Question. Do you have a transition plan and budget estimate prepared that will guarantee the success of the nuclear research into the future and continue to draw on the experience of the other national laboratories?

Answer. The execution of our nuclear energy R&D programs is guided by multi-year program plans that have been jointly developed by our Federal and national laboratory personnel. These program plans identify R&D activities will evaluate undertaking over the next 10 years and include estimates of the out-year budgets necessary to carry out those efforts. The continued participation of the national laboratories in executing the multi-year program plans is essential to the overall success of the programs. As an example, the attached chart displays the organization of the Department's Generation IV Nuclear Energy Systems and Advanced Fuel Cycle Initiative programs—note that this organization highlights important roles for several national laboratories. We expect that this approach will endure as these programs progress.

The attached chart illustrates the program integration for the Generation IV and Advanced Fuel Cycle Initiatives.



Question. Can you explain what would happen if full funding of $48 million isn't provided for costs associated with the restructuring of the Idaho National Lab restructuring plan?

Answer. The $43.8 million identified in the President's budget request for Laboratory Transition and Restructuring will assure that all current INEEL personnel remain employed through the contract transition period, thus enabling the new contractors to hire the staff that best fit their very different requirements. Without this funding, we would not be in a position to facilitate an effective transition of the laboratory staff.

Question. Would funding shortfalls delay the Idaho upgrades or will this put the entire nuclear energy R&D effort at risk with further delays?

Answer. Shortfalls in the restructuring request could require the Department to explore taking funds taken from the infrastructure or other programs at the site including the nuclear energy R&D efforts. Alternatively personnel could be terminated before the new contractors have an adequate opportunity to review their qualifications.

Question. The Budget Request includes $46 million for "one-time costs associated with restructuring the Idaho lab." Since EM was the previous landlord for this Lab, why aren't these one-time costs being paid by EM, instead of NE?

Answer. Most of the workers who may not find immediate employment with either new contractor will be support personnel who perform landlord type functions that benefit the entire site. As NE is now the site landlord, it falls to NE to fund this work since that office controls the affected functions.

Question. The Idaho Lab will have a difficult challenge establishing its research programs. In the past, the Idaho Lab could tax EM programs for LDRD to fund internal research. Now those EM funds are being swept into another contract. I am hearing that future EM funds can not be taxed to support the new INL. Is this correct and can you explain that logic?

Answer. The Idaho Cleanup Contract is designed to only fund those activities that directly support accelerated cleanup. As the cleanup work is not expected to continue indefinitely, it is not appropriate for the lab to rely on the cleanup contractor to fund ongoing research activities.

Question. Aren't you worried that the new INL will have too small a base of funding to derive any meaningful LDRD funding?

Answer. We believe that there will be adequate the funding available for LDRD projects in the future as the INL becomes a world class research center for nuclear technology development.

UNIVERSITY PROGRAMS

Question. How can progress in university programs be maintained when the overall pot of R&D funds, for universities and labs is slashed?

Answer. Over the past several years, the Department has had a substantial positive impact on the Nation's university nuclear engineering programs as evidenced by increasing student enrollments, re-establishing stronger academic programs, improving the performance and use of their research and training reactors, and attracting minorities to the nuclear engineering discipline. The University Programs budget for fiscal year 2005 is essentially equal to our fiscal year 2004 appropriation when it is considered without the one-time funding of $2.5 million for spent fuel transportation. In fiscal year 2005 the Office of Civilian Radioactive Waste Management will assume responsibility for university reactor spent fuel transportation and, therefore, the University Programs budget reflects the transfer of this activity. Funding for faculty and student research at our Nation's nuclear universities remains constant for fiscal year 2005.

In fiscal year 2005, the Department will integrate researchers from the Nation's universities into the Department's mainline nuclear energy R&D activities. The Department will use competitive, peer-reviewed solicitations focused on the university community to select the best ideas for meeting the technology challenges of our various research efforts. Funding for this university-based research will be derived from the Department's primary nuclear energy R&D programs, including the Generation IV Nuclear Energy Systems Initiative, the Advanced Fuel Cycle Initiative, and the Nuclear Hydrogen Initiative. Overall, the proposed funding for university R&D is $1.8 million higher in fiscal year 2005 than fiscal year 2004.

Question. I was pleased that additional regional consortia, now six in total, were created to enable students to have access to important research reactors. But how does addition of new consortia match with proposed 10 percent cut in the university program budgets?

Answer. The six consortia, under the Innovations in Nuclear Infrastructure and Education (INIE) program, are an unqualified success. Funding for this important and highly successful program is essentially equal to the level of fiscal year 2004, which supported the increase from four to six consortia.

LOUISIANA ENERGY SERVICES—ENRICHMENT

Question. In written response to questions in last year's review of the fiscal year 2004 budget, you stated:

"The Administration places a high priority on ensuring nuclear nonproliferation safeguards are in place and that access to sensitive technology is controlled. The information available to the Department indicates that URENCO has acted responsibly with regard to the control of sensitive technology and the employment of nonproliferation safeguards.

"The Department believes that LES's plans for the deployment of centrifuge technology in the United States are of considerable national benefit. Deployment of an LES plant will help assure the important energy security objective of maintaining a reliable and economical U.S. uranium enrichment industry.

"The Department believes there is sufficient domestic demand to support multiple commercial uranium enrichment plant operators in the United States and that competition is important to maintain a viable, competitive domestic uranium enrichment industry for the foreseeable future."

Does this response from the Department still stand?

Answer. Yes, we understand that URENCO continues to follow nonproliferation safeguards and controls on access to sensitive technology in accordance to agreements with the U.S. Government regarding to LES' deployment of centrifuge technology.

The Department also continues to believe there is sufficient domestic demand to support multiple commercial uranium enrichment plant operators in the United States and that competition is important to maintain a viable, competitive domestic uranium enrichment industry for the foreseeable future. Currently, domestic uranium enrichment capacity is less than half of U.S. nuclear fuel requirements. Over the next two decades, U.S. demand for electricity is forecasted to grow by 50 percent. Without the deployment of reliable and economical advanced technology and assuming nuclear power maintains its current share of demand, the share of U.S. nuclear fuel requirements met by foreign suppliers could rise to 80 percent in 20 years.

RADIOPHARMACEUTICALS

Question. Is the Department's policy of requiring that researchers, who require new radiopharmaceuticals, pay the full production costs coordinated with the Na-

tional Institutes of Health such that vital research in improved applications of radiopharmaceuticals is continuing at a rapid pace?

Answer. The Department's program requires that researchers pay for isotope development and direct production costs. Isotope production costs are accrued on a batch basis. The Department must obtain funding for the direct production cost for each batch before production can commence. Research customers have not been able to purchase the required isotopes in the manner currently required by the Department. Recognizing this and the impact this approach could have on medical research, the Department has engaged with the NIH. We are working with that agency to develop an approach to address this issue and to ensure that vital isotope-based medical research is not impeded.

Question. Are the two agencies, DOE and NIH in agreement that this is the appropriate place for these costs to be borne?

Answer. There have been positive discussions at the staff level. The Department continues to seek an agreement with the NIH that will lead to a resolution of this issue.

BARTER ARRANGEMENTS

Question. As part of DOE's fiscal year 2005 budget request for its Nuclear Energy Program, DOE is proposing to employ a "barter arrangement" to support the continuation of the technetium-99 activities currently being undertaken by USEC at the Portsmouth Site. Please describe the nature of the "barter arrangement" that DOE is contemplating?

Answer. At the end of fiscal year 2004, substantial quantities of both USEC and the Department's uranium inventories will remain contaminated with technetium-99 above the commercial standard for use as feed in a uranium enrichment process. Currently, processing the uranium at Portsmouth is the only economical means to remove enough technetium-99 contamination to allow it to be used as feed to the Paducah Gaseous Diffusion Plant. Because the cost to continue the technetium-99 removal activities is between one-third and one-half the replacement or market value, both USEC and the Department may benefit from the continuation of this program. A barter arrangement would help achieve realization of the full economic value of the uranium.

Question. Has DOE completed its evaluation of the need for additional legal authority to carry out the proposed "barter arrangement?" If so, please provide a copy of the evaluation. If not, when will this evaluation be completed? When it is completed, please provide a copy.

Answer. The Department has performed an informal evaluation and concluded that an additional authorization is not needed. Under section 3(d) of the Atomic Energy Act (AEA), the Department is to effectuate programs that encourage the "widespread participation in development and utilization of atomic energy for peaceful purposes." All of the material, with the exception of Freon, that is currently being contemplated for barter is "source material" as defined by section 11(z) of the Atomic Energy Act (AEA). Under section 63 of the AEA the Department is authorized to distribute source material, and under section 66 of the AEA the Department is "authorized and directed . . . to effectuate the provisions of this Act" to purchase or otherwise acquire supplies of source material. In addition, under section 161(g) of the AEA the Department is authorized to acquire, sell, lease, grant and dispose of real and personal property that the Department has acquired in connection with carrying out functions under the AEA or property that will be used to carry out objectives under the AEA. Pursuant to these existing authorities, the Department is authorized to enter into any of the barter arrangements that are currently being contemplated.

Question. What products or services is DOE contemplating using as "barter" under the proposed arrangement? Is DOE considering the option of transferring uranium from DOE's stockpile to USEC as part of a "barter arrangement?"

Answer. The products or services being considered for a possible barter arrangement are excess assets related to the Department's former uranium enrichment program, or services that are incidental to activities necessary to the final disposition of that programs legacy. The selection of materials is subject to negotiation and agreement by the other party.

Question. Section 3112 of the 1996 USEC Privatization Act includes a provision that explicitly requires DOE to undertake an evaluation of the impact of any sales or transfers of natural or low-enriched uranium on, among other things, the domestic uranium mining, conversion, and enrichment industry. In the event that any "barter arrangement" were established employing uranium from DOE's stockpile, would DOE agree that the provision in section 3112(d) would apply to any such

transfer? Does DOE consider a "sale or transfer" to include a "barter"? If so, please provide the analysis to support this conclusion.

Answer. The Department is not currently considering proposing to barter material that is subject to subsection 3112(d). However, if the Department were to use material subject to 3112(d), it would comply with the provisions of 3112(d). "Sale or Transfer" is a broad term which encompasses arrangements in addition to normal commercial sales such as barter transfer.

The Secretary is sensitive to his responsibility for the domestic uranium industry as detailed in the USEC Privatization Act and subsection 1014 of the Energy Policy Act of 1992, and has carefully considered the proposed activities. In addition to restoring the economic value to contaminated uranium inventory, any barter proposal would sustain 154 workers employed during fiscal year 2005 in the domestic uranium industry.

Question. Section 3112(d) also requires the recipient of any such uranium sales or transfers to pay the "fair market value of the material." In a barter arrangement, how would DOE address this "fair market value" requirement?

Answer. The Department is not contemplating a barter of material that is subject to subsection 3112(d). However, the barter would be an arms' length transaction for value that would take into consideration the ability to monetize the asset in a fashion adequate to meet the financial needs necessary to provide the services at the Portsmouth facility.

CERAMIC ION TRANSPORT MEMBRANES PROJECT

Question. For the past 7 years the DOE-Office of Fossil Energy (FE) and Office of Energy Efficiency and Renewable Energy (EERE) have supported a development project that uses ceramic Ion Transport Membranes (ITM) to produce hydrogen from natural gas. Selected through a competitive solicitation in 1997, the ITM Syngas project has been co-funded since that time by DOE-FE (75 percent), and DOE-EERE (25 percent). However the fiscal year 2004 funding for the project was reduced by EERE from $1.3 million to $200 thousand. The ITM Syngas project is currently in Phase 2 with the objective of operating a Sub-scale Engineering Prototype (SEP) that will demonstrate full conversion of natural gas to synthesis gas. Achieving this objective is critical to gaining the technical understanding to proceed to the project's next phase, a pre-commercial demonstration of the ITM Syngas technology. From the beginning of the project, EERE had committed to supporting the project through the end of Phase 2, and financial participation through completion of the SEP demonstration is necessary to maintain the project on schedule. After demonstrating full product conversion in the ITM Syngas process, smaller units could be developed that would be amenable to distributed hydrogen production.

In view of this critical stage of the ITM Syngas project, will DOE-EERE revise its fiscal year 2005 budget to provide $1.3 million for the project?

Answer. The ITM Syngas project was one of several hydrogen production projects for which EERE funding was reduced in fiscal year 2004 due to a shortfall caused by the large number of Congressionally-directed projects. The Department plans to meet its total obligations identified in the ITM cooperative agreement, subject to Congressional appropriations, the extent of fiscal year 2005 Congressionally-directed projects, and the results of the annual merit review that helps to guide our prioritization of research projects. EERE will determine its fiscal year 2005 contribution to the project following the completion of the fiscal year 2005 appropriation process.

QUESTIONS SUBMITTED BY SENATOR THAD COCHRAN

BIOMASS R&D AND NATIONAL LABORATORIES

Question. Mr. Garman, you mention in your written testimony that the Department is interested in working with industry and the National Laboratories to reach your goals of a large-scale biorefinery and advanced technologies to transform the Nation's domestic biomass resources into high value power. I believe that our National Labs provide a valuable service and conduct important research. What are you doing to ensure that this research and development is not overly entangled with the industries which fund such activities?

Answer. Our National Bioenergy Center facilitates the coordination of biomass research and development across the National Laboratories. The Center is focused on enabling long-term research needed to convert a wide variety of domestic biomass resources to fuels, chemicals, and heat and power in a sustainable manner. Through partnerships with industry, the Department fosters the nearer term research and

development that leverages the National Laboratories' foundational, enabling work. The public/private partnerships advance biomass conversion processes and integrate them into commercial systems and facilities for testing and performance validation. The National Laboratories are involved with industry's research and development through Cooperative Research and Development Agreements (CRADAs). These CRADAs are carefully constructed to avoid duplicative efforts and to ensure that our participation is an appropriate Federal role.

BIOMASS R&D AND UNIVERSITIES

Question. What role do you see our Nation's universities playing in this ongoing research and development?

Answer. Universities play an important role in the Biomass Program. One example is the Biomass Refining Consortium for Applied Fundamentals and Innovation (CAFI). With support from the National Laboratories, Federal Government, and industry, this group of universities focuses on various possible pretreatment technologies to identify options that enable the integrated industrial biorefinery. In addition, universities are collaborating with the National Laboratories on a variety of research projects as listed below:

—*Colorado School of Mines*.—Impact of Water Structure Modifying Agents and Cellulase Mutations on Cellulase-Cellulose Interactions,
—*University of Arkansas*.—X-Ray Crystallographic Studies of Cellulases,
—*Purdue University*.—Building A Bridge To The Corn Ethanol Industry Follow-On Project—Phase II,
—*University of Colorado*.—Boulder, Mechanistic Model Development for Biomass Thermochemical Conversion Process,
—*Cornell University*.—Molecular Modeling of the Interaction of Cellulose with Cellulases and Catalysts,
—*Cornell University*.—Improving T. fusca Cellulases by Protein Engineering,
—*Dartmouth University*.—The Role of Biomass in America's Energy Future,
—*University of Pittsburgh*.—Biorefinery Optimization Software.

Universities are also funded in fiscal year 2004 through the following congressionally-directed projects: Iowa State University, Iowa State University Center for Catalysis, Purdue University & the Midwest Consortium for Sustainable Biobased Products and Bioenergy, University of Louisville, Louisiana State University Agriculture Center, Mississippi State, and the University of North Dakota. While we do not support continuation of Congressionally directed projects, we expect that many universities would receive funds through a competitive awards process.

The Biomass Program continues to fund multi-disciplinary programs at universities to develop graduate programs that focus on biomass. The approach is to foster collaboration among various departments including business, science, and engineering. The Biomass Program also sponsors research internships at the National Renewable Energy Laboratory involving undergraduate and graduate students majoring in science and engineering. These internships allow the students to gain hands-on research experience under the guidance of prominent researchers.

QUESTION SUBMITTED BY SENATOR LARRY CRAIG

FUNDING A COMMERCIAL BIOMASS PLANT

Question. A biotechnology company is interested in building a commercial bio-ethanol production facility in the State of Idaho. This plant would use agricultural wastes—primarily wheat straw—as its feedstock. Using an enzyme-based process, the plant would convert the carbohydrates from the wheat straw into hydrocarbons for ethanol. The construction of this plant would demonstrate the long-term viability of using agricultural products to provide both energy and chemicals that have thus far been derived from petroleum. The success of this project will create new jobs in the agriculture, energy, technology, research, and construction sectors in Idaho and elsewhere. It will contribute to accomplishing the President's goal of reducing the greenhouse-gas intensity of the economy because the CO_2 emitted by burning ethanol is roughly equal to the CO_2 absorbed by growing the wheat—meaning that burning ethanol created from this process would add no net CO_2 to the atmosphere. Completion of this facility would also demonstrate a realistic way to begin reducing our Nation's dependence on foreign oil.

This cutting-edge project would be eligible for the loan guarantee program described in the energy bill conference report. Because that bill has not been sent to the President by the Congress, and because this project can serve multiple national

interests simultaneously, I seek your assistance in identifying existing authorities that would ensure the rapid construction of this facility.

Please identify any existing programs, funds or authorities that could be used by this company to secure financing and commence construction on this vitally important project.

Answer. The Department of Energy does not have any program funding available to support this effort at this time. The Department of Agriculture (USDA) conducts a loan guarantee program under Section 9006 of the Farm Bill that has funded small grain-based ethanol plants. However, because the proposed plant is a first-of-a-kind facility with a high degree of technical and financial risk, this project may not receive funding under the USDA program. The Department is unaware of any other Federal programs that would fund this project.

QUESTIONS SUBMITTED BY SENATOR TED STEVENS

ALASKA EXAMINATION OF GEOTHERMAL SITES

Question. In September 2003, Assistant Secretary David Garman and Dr. Roy Mink traveled to Alaska to examine geothermal sites, determine their viability for electricity production, and to assess ways in which the Department of Energy can assist in developing this energy resource. What steps has the Geothermal Technologies division and the Office of Energy Efficiency and Renewable Energy taken towards this end?

Answer. The Geothermal Technologies Program has reached out to help Alaska define its geothermal resource and to begin building a base for development of that resource. A database of potential geothermal resources has been developed that targets two areas in Alaska for possible power plant developments (Akutan and Unalaska).

The Program is also providing assistance to private developers, one working with the Native Corporation to establish a basis for development of a power plant at Akutan and another developer who has an interest in working with the Native Corporation for a potential power plant at Dutch Harbor (Unalaska). We are also working with the Kotzebue Electric Association to evaluate existing geothermal data and provide a basis to evaluate potential use of geothermal thermal energy to protect the town sewer system from freezing.

As a result of the September 2003 trip, the Geothermal Technologies Program has included additional funding opportunities for Alaska. The Geothermal Outreach funding opportunity announcement (State Energy Program) closes on April 6, 2004. The Geothermal Resources Exploration and Definition funding opportunity announcement will be released on March 18, 2004, and the Power Plant Development funding opportunity announcement will be released near the end of March 2004. These announcements will provide up to $5 million of geothermal funding in fiscal year 2004.

DOE also provided $100,000 to the Alaska Division of Energy to support development of a working group to promote geothermal energy awareness in Alaska.

ASSISTANCE TO ALASKA COMPANIES

Question. Given the extraordinarily high cost of energy in rural Alaska, many utility companies are exploring the possibility of harnessing wind energy to supply rural communities with electricity. What assistance is the Office of Energy Efficiency and Renewable Energy providing to these companies?

Answer. The Department of Energy supports wind power projects in Alaska through several local and State organizations. There are ongoing wind projects with Kotzebue Electric Association, the City of Unalaska, and TDX Corporation (St. Paul Island) that are aimed at providing lower cost energy alternatives to rural Alaskan communities. Through the Department's Tribal Energy Program, renewable energy studies are underway for Southeast Alaska, the Yukon-Kuskokwim Delta region, and the Bristol Bay region. National Wind Technology Center personnel provide expert technical support to these projects by supplying anemometers, evaluating the wind resources, conducting wind workshops, and sponsoring local representatives to attend technical workshops.

EVALUATION OF RENEWABLE ENERGY SOURCES ON PUBLIC LANDS

Question. In February 2003, the Department of Energy and the Department of the Interior released a report evaluating renewable energy resources on public lands. Alaska was excluded from this report. Will the Department of Energy undertake a similar evaluation of renewable energy resources on public lands in Alaska?

Answer. The Geothermal Technologies Program is working with the United States Geological Survey on a limited geothermal resource assessment for the western United States, including Alaska. Comprehensive energy legislation pending in the Congress requires thorough annual assessments of all renewable energy resources, including solar, wind, biomass, ocean, geothermal, and hydroelectric, in all 50 States.

TIDAL ENERGY PROJECTS COST IN ALASKA

Question. The use of tidal energy is currently being explored in Alaska. As you know, the coast of Alaska has exceptional energy producing potential. Tidal energy projects have high capital costs. Is the Office of Energy Efficiency and Renewable Energy exploring opportunities to harness tidal energy?

Answer. The Department is not currently funding research in tidal energy. Since there are only two areas of the Nation with a significant tidal flux (Cook Inlet, Alaska; Bay of Fundy, Maine) the application of tidal energy is not considered widely applicable.

RENEWABLE ENERGY PROGRAM IN ALASKA

Question. Please describe in detail the Department of Energy's (DOE) renewable energy program in Alaska.

Answer. Some of the activities DOE is funding in renewable energy in Alaska are described below. All of these projects were Congressionally directed. We strongly support competitive awards to ensure that the Department's program goals are advanced and taxpayer dollars are spent wisely.

Biomass

The Department is supporting an ethanol production facility with Sealaska Corporation in Ketchikan that will utilize wood residues produced from various forest industry operations in a process to produce fuel grade ethanol. Regional Biomass Energy Program funds support a biomass energy specialist at the State level who assists developers with regulatory and utility issues, provides technical assistance, and in some cases provide financial assistance. The Regional Biomass Program also contributed to the Dutch Harbor Fish Oil Demonstration Project which demonstrated blending fish oil with diesel oil to power engine generator sets that provides electricity to the town of Dutch Harbor.

Wind

DOE has been supporting wind power projects in Alaska for several years through various local and State organizations. There are ongoing wind projects with Kotzebue Electric Association, the City of Unalaska, and TDX Corporation (St. Paul Island) that are aimed at providing lower cost energy alternatives to rural Alaskan communities. National Wind Technology Center personnel provide expert technical support by supplying anemometers, evaluating the wind resources, conducting wind workshops, and sponsoring local representatives to attend technical workshops. The Department has also tested cold weather wind turbines to mitigate performance problems in extreme-cold climates (e.g. icing on blades and gear box freezing).

Geothermal

The Department assisted the Alaska Energy Authority in completing a statewide assessment of geothermal resources. The assessment concluded that geothermal resources near the community of Akutan have the potential to displace a substantial portion of the 4.3 million gallons of diesel per year used for generating power and heat in the community and fish processing plant. The Department has also supported site specific feasibility investigations. This past September, Assistant Secretary Garman accompanied the Geothermal Program Manager to Alaska to examine several geothermal sites to determine their viability for electricity production. The Geothermal Technology Program is supporting a geothermal working group to promote geothermal energy awareness in Alaska. This group will be visiting Nevada on a trade mission to learn about successes and procedures used by Nevadans to develop geothermal energy.

Hydropower

The Department has supported a number of hydropower technology development efforts in Alaska over the years. Currently, DOE is supporting the Alaska Village Electric Corporation in a hydropower feasibility study at Scammonbay, and a Power Creek hydro-electric project in Anchorage.

State Energy Program

The State Energy Program provides base-level funding for Alaska to maintain energy specialists in State government. Funding is used to conduct resource assessments, fund projects, and provide technical assistance and workshops.

Tribal Energy Program

Renewable energy studies are underway for Southeast Alaska, the Yukon-Kuskokwim Delta region, and the Bristol Bay region.

QUESTIONS SUBMITTED BY SENATOR HARRY REID

FOR INSPIRATION AND RECOGNITION OF SCIENCE AND TECHNOLOGY (FIRST)

Question. In the fiscal year 2004 Conference Report we carried language encouraging the Department to support competitors in the For Inspiration and Recognition of Science and Technology (FIRST) robotics competition, a brainchild of Dean Kamen, the inventor of the Segway and several other remarkable devices. Do you mind describing what the Department has done to follow-up on this direction?

Answer. Brookhaven National Laboratory (BNL) scientists and engineers provided significant support to students of William Floyd High School, Mastic Beach, NY, in the form of technical guidance and assistance in the fabrication of the components to build a robot. BNL is providing the funding necessary to purchase the competition kits for Longwood High School, Middle Island, NY, and Port Jefferson High School, Port Jefferson, NY, to participate for the FIRST event. Additionally, special times for operation of the machine shop were provided by BNL. The FIRST competition is exciting and rewarding with the per team costs typically running between $10,000 to $15,000. The Office of Science provided $20,000 to BNL to support these three high school teams' participation in the FIRST event.

IOWA ENVIRONMENTAL/EDUCATION PROJECT

Question. Is the Iowa Environmental/Education Project, something that has been described to me as a giant, $200 million roadside terrarium, a worthy investment of Federal funds that will generate useful, cutting edge science or is it just a huge waste of Federal taxpayer dollars?

Answer. This Congressionally directed project will develop an environmental and "green energy" education center on a 30 acre Environmental Protection Agency Brownfield site in Coralville, Iowa. It will not be a cutting edge research facility. The project includes an indoor tropical rain forest, aquarium, educational center, and galleries on the prairie eco-system, Midwest geology, and agriculture.

USER FACILITIES

Question. We have a large capital investment in the Office of Science user facilities that serve many users at universities and laboratories. Are we operating these facilities at maximum capacity in the fiscal year 2005 budget to meet the needs of these scientists?

Answer. Overall, Office of Science user facilities are operating at 95 percent of optimum in the fiscal year 2005 request, 3 percent better than in fiscal year 2004. (This metric is straightforward but perhaps too simplistic, and we are working to develop a more sophisticated metric for the fiscal year 2006 President's Budget.) It is always difficult to find the right balance among competing priorities for facility operations, research, construction, etc. We are satisfied that we have allocated the funding in the request to achieve the best balance possible.

INTERNATIONAL THERMONUCLEAR EXPERIMENTAL REACTOR (ITER)

Question. As I mentioned in my opening statement, I am pleased that the United States has resumed its participation in the ITER ("EATER") project. However, the dollar levels look somewhat low, particularly in light of our commitment to fund 10 percent of the total. Are the funds in the budget adequate to fulfill our international requirements?

Answer. The fiscal year 2005 budget request for ITER is adequate because the funds are for preparations for a subsequent ITER construction project. The plan is for the construction project to start in fiscal year 2006, at which time the U.S. funding requirement would increase significantly.

Question. As a follow-up, the U.S. participation seems fairly modest compared to that of several of the international partners. Are you satisfied that it appears that

the United States will be just a junior partner in ITER. Is a larger role something we should aspire to?

Answer. The Department is satisfied that the 10 percent role is appropriate for the United States. With the exception of the host, all of the ITER Parties would be at approximately the same level of participation. Each Party would receive the same benefits in terms of equal access to the scientific and technological results from ITER, as well as an equal role in planning the ITER scientific program. Accordingly, a larger financial contribution for the United States is not considered necessary.

Question. Dr. Orbach, as I understand it, the Department is getting ready to select a site for a U.S. ITER Project Office. Could you please explain the process for that selection?

Answer. The process for selection of the host for a U.S. ITER Project Office consists of review by an independent Evaluation Committee of Federal and non-Federal employees. This process will be managed by the Chicago Operations Office. The conclusions of the Evaluation Committee will be forwarded to the Office of Fusion Energy Sciences for selection of the host by the director of that office.

Question. Given the importance of the ITER project to fusion research and to the fusion community, has an expert independent review board been appointed to guide that selection?

Answer. We are in the process of identifying members of such a board.

FUNDING FOR CONCENTRATING SOLAR POWER

Question. I see that you have a $2 million request for funding for the Concentrating Solar Power portion of the solar energy budget. While I realize this is an improvement from the $0 you requested last year it is a far cry from what I expected given that your office, the National Academy, and many other national organizations all now agree that CSP has merit and promise. Despite your words to the contrary, are you giving up on Concentrating Solar Power?

Answer. We are not giving up on Concentrating Solar Power (CSP). As you pointed out, last year we did not request any funding for CSP. In light of recent studies we sought from an independent engineering firm, a draft of which was reviewed by the National Research Council, we propose $2 million to support a more thorough investigation of the appropriate R&D course needed to realize the potential for CSP. The fiscal year 2005 budget request will be used to maintain CSP facilities at Sandia National Lab, to provide analytical support to States, and to develop a comprehensive program plan to help inform the fiscal year 2006 budget development process and a longer term R&D plan.

Question. If not, what do we need to do to get this program back on track?

Answer. DOE will develop a Concentrating Solar Power (CSP) program plan which will use recommendations from the independent review studies and take a systems approach to identify the highest value technology R&D investments. These findings will then be used to inform the fiscal year 2006 budget development process and a longer term R&D plan.

NATIONAL RENEWABLE ENERGY LABORATORY

Question. In the last three conference reports we have carried language directing the National Renewable Energy Laboratory (NREL) to deploy some of their technologies in Nevada in partnership with industrial and university partners. It is my understanding that this effort is working out well for everyone involved, but I would be interested in your thoughts.

Answer. As a matter of principle and administration policy, we do not support earmarks. Nevertheless, over the past 2 years, the Department has worked closely with NREL and various State interests in order to make the most effective use of these directed funds. A competitive process was used to select projects that would bring laboratory, university, and industrial partners together in the State of Nevada to help develop the solar, geothermal, wind, and related hydrogen resources in the Southwest. Per fiscal year 2004 Congressional direction, the Department will continue these efforts and look for additional opportunities to form alliances between Nevada's university system, other Nevada State agencies, and industry to establish centers of renewable energy expertise in the State. The "RE Centers of Expertise" will likely include, but not be limited to, research and development, training for future workers in renewable energy, and technology demonstration and performance validation.

BIOMASS RATIONALE FOR CUTS

Question. Biomass seems to have taken a substantial cut in the fiscal year 2004 request. By all accounts this program has been very successful. Why are you cutting back at this time?

Answer.

FUNDING SUMMARY

[In thousands of dollars]

Program/Activity	Fiscal Year 2004 Request	Fiscal Year 2004 Comparable Appropriation	Fiscal Year 2004 Earmarks	Fiscal Year 2004 Unencumbered Appropriation	Fiscal Year 2005 Request
Biomass Program (EWD and Omnibus Appropriation)	69,750	86,471	42,805	43,666	72,596
Biomass Program (Interior)	8,808	7,506	.....	7,506	8,680
Total, Biomass Program	78,558	93,977	42,805	51,172	81,276

Excluding all the Congressionally-directed projects in fiscal year 2004, we are actually seeking $30 million more in fiscal year 2005 than was appropriated last year toward the research and development (R&D) goals established in our program plan and budget submissions. Our R&D goals have been developed in consultation with the U.S. Department of Agriculture, National Laboratories and the Biomass R&D Advisory Board established by Congress.

In order to fund Congressionally-directed projects in fiscal year 2004, we have had to modify our program goals. Furthermore, we will experience delays in achieving our key milestones and the broader market acceptance of power, fuels and products derived from biomass. We urge the committee to provide us the flexibility to spend Biomass funds in accordance with our program plans, which will provide the best potential for producing long-term positive returns on the taxpayers' investment.

HIGH TEMPERATURE SUPERCONDUCTOR PROGRAM

Question. Do you think that the High Temperature Superconductor program should be moved back into your organization, particularly in light of the wholesale redirection of funds away from superconductors that the Electricity Transmission and Distribution program has undertaken?

Answer. The new Office of Electric Transmission and Distribution (OETD) has voiced its strong support for High Temperature Superconductivity (HTS). The funding of the High Temperature Superconductor Program is not a result of the office in which the program is housed, but rather the fact that Congress appropriated $10.972 million less for transmission and distribution R&D in fiscal year 2004 than in fiscal year 2003, the year before the new office was created. Of the $69.467 million appropriated for R&D within OETD, $25.75 million was for Congressionally Directed Activities, leaving only $42.49 million ($6.285 million less than in fiscal year 2003) for all R&D work.

FINANCIAL ASSISTANCE TO GEOTHERMAL DEVELOPMENT IN ALASKA

Question. What percentage of the division's budget will be dedicated to providing financial assistance to geothermal development in Alaska?

Answer. The fiscal year 2004 budget for the Geothermal Technologies Program is $26 million. The program provides opportunities for Alaskan entities to participate in open and competitive funding opportunity announcements. Current and upcoming opportunities are valued at a total of $5 million, or 19 percent of the program's budget. Alaskan proposals will be considered alongside others in open competition.

QUESTIONS SUBMITTED BY SENATOR PATTY MURRAY

GENOMICS: GTL FACILITIES

Question. Dr. Orbach, I understand you have recently published a strategic plan for new facilities supporting DOE's missions. PNNL, along with other research Institutions in the State of Washington, is very interested and, indeed, believe we have a strong research infrastructure to be the location of one of the GTL facilities in your strategic plan and facilities plan.

What is your position on the schedule for the various facilities with the genomics program, including the proteome analysis facility?

Answer. Our 20-year facilities plan lays out the time sequence of the scientific user facilities, including those advocated by our Genomics program. As the Genomics program evolves we hope to be able to proceed with the construction and operation of the Genomics facilities. PNNL, along with other research institutions in the State of Washington should be in a strong position to successfully compete for one or more of these facilities. I should also note that while the facilities plan lists four large Genomics facilities, it is conceivable that evolving scientific needs and the competitive solicitation process for each facility could lead to us to fund multiple distributed facilities at a smaller scale. As available funding allows, we intend to let the science drive the ultimate makeup of these facilities.

ULTRA HIGH-SPEED SUPER COMPUTERS

Question. The Department of Energy has recently announced an aggressive computing program, including ultra high-speed super computers. What is your position on competition?

Answer. The Department believes that competition is critical to ensuring effective stewardship of the taxpayers' investment in science as well as selection of the best ideas to ensure the scientific leadership of the country. We have just announced a solicitation to the Office of Science laboratories to begin installation of a leadership class computer for open science. The award will be made on the basis of peer reviewed open competition.

HYDROGEN IN THE PACIFIC NORTHWEST

Question. What are the unique assets that research institutions and the natural resources of the Pacific Northwest provide that will make hydrogen a reality in the Northwest?

Answer. The Pacific Northwest uses renewable energy resources to produce much of its energy. These resources can be tapped to produce hydrogen. Hydropower is a carbon free source of inexpensive electricity that can produce hydrogen via electrolysis. Wind can also be harnessed to create hydrogen via electrolysis, with Washington and Oregon alone possessing over 8,000 megawatts of developable wind generation potential.

The Northwest is home to many organizations with the ability to play a part in developing a hydrogen infrastructure. These include State and city governments, the Bonneville Power Administration, fuel cell developers (Ballard, Avista labs, IdaTech, etc.), major regional universities, heavy truck and aerospace manufactures, Pacific Northwest National Laboratory, and Idaho National Engineering and Environmental Laboratory.

TIME SCALE FOR HYDROGEN IN NORTHWEST

Question. In what time scale do you see hydrogen being a viable source of energy in the Northwest?

Answer. Hydrogen is not a source of energy, but an energy carrier that can be produced from multiple energy resources. Because of the many technical and cost hurdles associated with a transition to a hydrogen economy, we don't expect wide scale use of hydrogen—in the Northwest or elsewhere—before 2020.

INDUSTRY-LABORATORY COOPERATION

Question. Can you tell me more about industry's role in research development and demonstration projects in the effort to develop a more robust grid; specifically efforts underway involving national laboratory and industry cooperation?

Answer. Industry-laboratory partnerships enable the full development and/or deployment of new and promising technologies that form the cornerstone of DOE's efforts to modernize the Nation's Electric Transmission infrastructure.

Within the High Temperature Superconductivity's (HTS's) Strategic Partnership Initiative (SPI), Los Alamos National Laboratory (LANL), Oak Ridge National Laboratory (ORNL), IGC SuperPower, Waukesha Electric Systems, Southwire Company, and American Superconductor are the primary partners working together to develop High Temperature Superconducting (HTS) wire, and four types of HTS electric power equipment prototypes, including cables, motors, generators and transformers. This technology will enable distribution and transmission cables that have three to five times the capacity of conventional copper cables and higher efficiency (especially useful in congested urban areas), and power equipment with half the energy losses and half the size of conventional equipment.

Examples of current research and development projects—all involving DOE-Industry cost sharing—include the Boeing Phantom Works with Argonne National Laboratory to design, fabricate and test a 35 kilowatt hour superconducting flywheel energy storage system as a power risk management system that will give power users and utilities a full-scale device to manage both cost and reliability risks; the General Electric HTS Generator Project involving LANL and ORNL to install a 100 MVA prototype generator; the IGC SuperPower project with LANL to develop and install a transformer component at a HTS substation; and the Long Island Power Authority project with LANL involving the installation of a HTS cable system.

Lawrence Berkeley National Laboratory has the lead for the national laboratory/industry/university consortium that was formed to support cutting-edge research in Transmission Reliability R&D, provided support on the summer 2003 Blackout Investigation, and is integral to projects for developing reliability tools.

The Pacific Northwest National Laboratory (PNNL) is part of the national laboratory/industry/university consortium that was formed to support research on Transmission Reliability R&D to transform the Nation's distribution system. PNNL conducts evaluations of the technological and institutional aspects of recent reliability events on the Nation's electric power system, and is the lead for research activities in real-time monitoring and control of the power grid. PNNL partners with the GridWise Alliance, in which IBM, SEMPRA, the Pennsylvania, New Jersey, Maryland Interconnection (PJM) and others work to modernize the Nation's electric distribution system in potentially revolutionary ways.

In fiscal year 2004, PNNL has provided support on the summer 2003 Blackout Investigation. PNNL supports development of communication and control architectures and technologies, as well as the integration of multi-vendor distributed energy resources into the distribution system. PNNL supports development of technologies for improved load/demand management while responding to market prices and electricity supply/demand conditions.

Sandia National Laboratory (SNL) participates in a national laboratory/industry/university consortium to support research on Transmission Reliability R&D. SNL also works to develop advanced superconductors based on the sol-gel chemical deposition process. For energy storage, SNL develops improved energy storage system components including power conversion electronics and modular multi-functional energy storage systems.

Argonne National Laboratory performs research and development for the HTS Program Activity. Argonne utilizes unique expertise in ceramics and materials science to improve conductor performance and to investigate deposition processes, such as metal-organic chemical vapor deposition. Argonne also performs research on superconducting electric motors, transmission cables, and flywheel electricity systems.

SUBCOMMITTEE RECESS

Senator DOMENICI. So that's it. We stand in recess. Thanks.

[Whereupon, at 11:23 a.m., Wednesday, March 3, the subcommittee was recessed, to reconvene subject to the call of the Chair.]