MINUTES
JOINT MEETING

HOUSE ENVIRONMENT, ENERGY, & TECHNOLOGY COMMITTEE
SENATE STATE AFFAIRS COMMITTEE

DATE:	Wednesday, March 02, 2016
TIME:	1:30 P.M.
PLACE:	WW02 - Lincoln Auditorium
MEMBERS:	Chairman Thompson, Vice Chairman Anderst, Representatives Raybould, Hartgen, Vander Woude, Nielsen, Anderson, Mendive, Trujillo, Beyeler, Chaney, Nate, Scott, Smith, Rusche, Jordan, Rubel Chairman McKenzie, Vice Chairman Lodge, Senators Davis, Hill, Winder, Siddoway, Lakey, Stennett, Buckner-Webb
ABSENT/ EXCUSED:	Representative(s) Scott, Vice Chairman Lodge, Senators Stennett, Siddoway
GUESTS:	John Chatburn, Office of Energy Resources (OER); Scott Pugrud, OER; Shannon Graham, OER; Kirk Sorensen, Flibe Energy; Bryce Olpin, Flibe Energy; Matt Memmott, BYU; Scott Barney, Millard County, Utah; Mark Peters, Idaho National Laboratory (INL); Corey Taile, INL; John Revier, INL; Pat Barclay, Idaho Council on Industry and the Environment; Lee Barron; Maurice Clements; Vicky Lucin; Eli Brown; Chris Miller; Mitch Skelton

Chairman Thompson called the meeting to order at 1:30 p.m.

MOTION: **Rep. Anderst** made a motion to approve the minutes of the February 24, 2016, meeting. **Motion carried by voice vote.**

Dr. Mark Peters, Director, Idaho National Laboratory (INL), gave a presentation on updating Idaho's actions regarding research into advanced nuclear and energy studies. The vision of the INL is to change the world's energy future and secure the nation's critical infrastructure by advancing nuclear energy, enabling clean energy deployment, and securing and modernizing critical infrastructure. Their goal is to lead in research and development of nuclear energy, sustain and maintain the 99 existing nuclear reactors in the United States, and find a solution to the spent fuel challenge. Currently, spent fuel is stored on-site. Without the deployment of spent fuel, research will not be able to move forward with nuclear power.

By 2030, most of the currently active reactors will be retired. That loss of energy generation will need to be replaced. One alternative is the Small Modular Reactor (SMR). A consortium of municipal utilities and the Department of Energy (DOE) see the SMR as a bridge to the next generation of reactors. Nuclear energy is clean energy. Other options under consideration are developing biomass technology for fuel and advanced batteries to power vehicles.

Dr. Peters stated another goal for the INL is performing product-to-market testing with industry partners to verify the feasibility of creating potential products. A third goal is researching how to protect the infrastructure of gas, transportation, and telecommunications from threats such as natural disasters and cyber-attacks. Three pillars of simultaneous excellence shape the future of the INL: scientific and technical excellence, community excellence, and operational excellence. The INL is a part of Idaho. It is committed to being a good steward of the environment.

The Gateway for Accelerated Innovation in Nuclear (GAIN) seeks to advance nuclear power as a resource capable of meeting the nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration. It is taking advantage of the fast-track pace at which we do business to enable the next generation of reactors to be built. The Molten Salt Reactor (MSR) is an investment opportunity for Idaho. The SMR is funded by the DOE and is due to be operational by 2030-2035.

The Carbon Free Power Project (CFPP) is being developed in Corvallis, Oregon, in conjunction with the DOE and Utah Associated Municipal Power Systems (UAMPS). INL is working with CFPP to support a Nuclear Regulatory Commission-approved site meeting the DOE's goals to deploy an SMR. The preferred site will be identified soon, then site characterization will begin, with an operational SMR planned for 2023.

Dr. Peters explained how INL can address the world's most challenging problems. It can enable the warfighter, the intelligence community, and first responders. It can research ways to secure industrial control systems, such as electrical grids, military vehicles, phones, and cars, across critical infrastructure sectors which can be entry points for hackers. There is an awakening awareness by industries and the DOE of this credible threat. INL can do research to design systems that are more resilient to being hacked.

The Center for Advanced Energy Studies (CAES) is a research and education consortium between INL, Boise State University, Idaho State University, University of Idaho, and University of Wyoming. It provides research and development funding and equipment for students' research at INL. In its next phase, the goal for INL is to engage industry in the CAES process.

Dr. Peters continued that the INL is expanding, with 500 people hired in 2015 and steady growth in business volume. It is also facing challenges. Currently 30% of the workforce is over age 50. A new generation of scientists will be needed to fill the pipeline of employees. There is a national STEM hiring crisis: the curriculum does not match the hiring need, and soft skills and on-the-job-familiarity are lacking. INL would like to partner with university programs to target schools that best match skill set/degree needs, tie interns into needed disciplines, and design and build better curricula. INL would also like to tie STEM to industry needs and bring awareness of future career opportunities in Idaho by promoting and encouraging diversity and rural school connections so in the future the right workforce will be available.

The INL would like to build on its relationship with Idaho by continuing to grow CAES; developing partnerships with the Idaho Department of Labor and the Idaho Department of Commerce to drive high-wage job growth; encouraging STEM efforts; utilizing INL's facilities for high-performance computing, cyber, computer engineering, and materials science; and advancing programs in Washington D.C.

Dr. Peters introduced associates at INL: **Amy Lientz,** Partnerships, Engagement & Tech Deployment; **John Revier,** Director, State and Regional Government Affairs; and **Corey Taile,** one of the best writers in the business.

Dr. Peters answered questions from the committee, saying the status of the research quantities of spent nuclear fuel is still being negotiated daily with the DOE and the Attorney General's office. Getting the shipment would help with INL research into spent fuel. The cleanup of nuclear waste has been a barrier to production. Treatment of waste continues and is being stored safely on-site. Finding a new waste-treatment process is technically challenging, and it takes time to make sure it works. Currently spent fuel is being buried. **Amy Lientz** stated the recession in 2008-2009 reduced the budget to about $800 million at that time, leading to a reduction in staff of about 500 people. However, INL has recovered and grown past it. The funding from the federal government is set every two years, so budget projections are controlled by that.

Dr. Peters continued by saying in the event of an electromagnetic pulse, the government believes the country would be protected from its effects based on research. Scientists are still analyzing the what-ifs should one occur. The legislature can help INL by encouraging education, seeking to attract clean energy industries to Idaho, and advertising the benefits of living in Idaho. This would benefit the entire region. **Amy Lientz** stated the INL is on the board of the Idaho Global Entrepreneurial Mission (IGEM), which targets opportunities for future grant program funds.

In response to a question regarding funding at the INL, **Dr. Peters** explained the INL is government owned but contractor operated (GOCO). INL is not for profit; its purpose is scientific research. The universities are partners in that contract. The dollars for research and development come from the federal government. One way to benefit the region is to talk about the opportunities at the laboratory, such as by holding job fairs.

Mr. Kirk Sorensen, President and Chief Technologist, Flibe Energy, gave a presentation on solving important problems with liquid fluoride thorium reactors (LFTR). Industrial civilization expects reliable, affordable energy. There are three options for using nuclear fuel. The first two use uranium; the third uses the element thorium, which is a relatively untraveled path. Thorium is much more common than uranium. The richest deposit of thorium in the western hemisphere can be found in the area of Lemhi Pass in Idaho. It could supply energy to the world for millions of years. There is also a stockpile of thorium buried at the Nevada test site. Thorium is easier to process than uranium and does not provide as much toxicity.

Today's nuclear fuel is fabricated with extraordinary precision. But it is that precision that makes it difficult to recycle and to refabricate. A new approach is needed that is more versatile and less expensive. Molten fluoride salt is an excellent carrier for uranium nuclear fuel. It eliminates an entire step of fabrication. Fluoride salt is chemically stable, impervious to radiation damage, and enhances safety features. In current pressurized water reactors loss of integrity of the vessel could cause a nuclear reaction. The new reactor is not under pressure. It is equipped with a "freeze plug," an open line where a frozen plug of salt blocks the flow of the liquid fuel. The plug is kept frozen by an external cooling fan. In the event of a total loss of power, the freeze plug melts and the core salt drains into a passively cooled configuration where nuclear fission and meltdown are not possible.

Mr. Sorensen stated the United States is facing a "retirement cliff" of nuclear power plants, as most will be retired by 2030. The DOE sees industry as leading the future of nuclear power to maintain reliable sources of energy in the future. The INL is trying to operate on these objectives. Modular construction of nuclear reactors in a factory environment has become increasingly desirable to reduce uncertainties about costs and quality. Liquid-fluoride reactors, with their low-pressure reactor vessels, are particularly suitable to modular construction in a factory and delivery to a power generation site. Flibe Energy was formed in order to develop liquid-fluoride reactor technology and to supply the world with affordable and sustainable energy, water, and fuel. Thorium and beryllium, two important materials for this project, are found in Idaho and Utah.

An abundance of advanced manufacturing opportunities exist for this technology. Thorium reactors can produce inexpensive electricity essentially indefinitely, but any reactor technology, conventional or advanced, will find it difficult to offer attractive returns to risk investors at current electrical prices; so production of medicines from the reactor can pay for the considerable costs of development and will attract public support.

Mr. Sorensen explained medical radioisotopes are used for many medical diagnostic tools. Molybdenum-99, which is transformed into technetium-99m (Tc-99m), is used as a radioactive tracer that allows for scanning procedures which collect data rapidly but keep total patient radiation exposure low. It dominates world medical radioisotope use. It is predominantly used in cardiac scans, bone scans, and gall-bladder scans. This industry has a value of approximately $2 billion per year.

The production reactors for Tc-99m are old. Research reactors producing molybdenum-99 exist around the world but the largest are in Netherlands and Canada. The Canadian reactor will shut down in 2018, leading to a shortage of Tc-99m. An innovative solution to the problem would be to use liquid thorium fuel, which is impervious to radiation damage. It has simplified chemical processing, and no fuel would be wasted. A small MSR research and test reactor could produce $160 to $713 million revenue each year from the generation of radioisotopes. In the competition for creating medical isotopes, the traditional method only makes the isotope, while an MSR would also be producing power.

Mr. Sorensen then outlined another medical benefit of thorium. Alpha-emitting bismuth-213 is very effective in fighting dispersed cancers like leukemia and lymphoma. It is produced using uranium 233 (U-233) which comes from thorium. The only way to get it is to use a thorium reactor to make the bismuth-213. After use, it ends in stable and non-toxic natural bismuth (the active ingredient in Pepto-Bismol). However, the world inventory for processed U-233 is stored in one place, the Oak Ridge National Laboratory, and it is slated to be destroyed. In May 2008 the Inspector General of the DOE issued a strongly-worded report to stop the destruction of U-233, stating "The loss of the U-233 will have significant impact on medical research which is now requiring a greater supply of progeny isotopes than ever before." A large source of unprocessed U-233 is contained at the INL in the form of unirradiated fuel. It would be logical to process this to start thorium reactors.

The results of these efforts will bring a revolution of medical treatment and medical diagnostics. It will enable scans to diagnose problems and follow up with treatments for some of the most severe and dangerous forms of cancer. It will save tens of thousands of lives through targeted alpha therapy. In addition it will enhance lives through affordable and clean energy.

Mr. Sorensen answered questions from the committee, saying the research on thorium was started during the Manhattan Project. **Dr. Glenn Seaborg** discovered thorium and U-233. He studied thorium and discovered it to be unsuited to weapon production, but he also discovered that thorium had potential as an almost unlimited source of energy because of its abundance in the earth and the efficiency at which it can be consumed. They began to work on designing a LFTR, but when **General Groves** found out about it he immediately shut it down, saying only wartime priorities would be pursued. After the war, the nuclear energy generating program had progressed using uranium, and the properties of thorium were forgotten. **Alvin Weinberg** quietly pursued research on thorium until he was fired.

The SMR is small because it does not have the constraint of controlling pressure. A large reactor is cheaper to build because it requires a pressurized system. When pressure is no longer a constraint, and when you remove the need for emergency systems to monitor and maintain the pressure, everything becomes vastly simpler. Moving to a non-pressurized reactor would be suitable for air cooling in desert regions, rail deployment, and rapid assembly and integration at a desired site.

ADJOURN: There being no further business to come before the committee, the meeting was adjourned at 2:58 p.m.

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Representative Thompson

Chair

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Diana Seba

Secretary