EMD Uranium (Nuclear Minerals) Committee

2013 EMD Uranium (Nuclear Minerals and REE) Mid-Year Committee Report

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Committee Activities

During the past six months, the Uranium Committee (UCOM) continued to monitor the expansion of the nuclear power industry and associated uranium exploration and development in the United States and overseas. Robert Odell, the Committee's Vice Chair (Industry) has retired and we will miss him. In his place, Henry M. Wise, P.G. has been appointed as the new Vice Chair (Industry).

Input for the Mid-Year Report has also been provided by Steven Sibray, C.P.G., Vice Chair (University) on university activities in uranium research, and by Robert Gregory, P.G., Vice Chair (Government) on governmental (State and Federal) activities in uranium research, with special input from other members of the Advisory Group.

Thorium activities are also updated in this mid-year report. Finally, the Committee continues to report on rare-earth activities, an activity approved by the UCOM in 2011. We provide summary information on current rare-earth exploration and mining, and associated geopolitical activities.

The EMD Uranium (Nuclear Minerals) Committee is also pleased to remind the reader that the Jay M. McMurray Memorial Grant which is awarded annually to a deserving student whose research involves uranium or nuclear fuel energy. This grant is made available through the AAPG Grants-In-Aid Program, and is endowed by the AAPG Foundation with contributions from his wife, Katherine McMurray, and several colleagues and friends. Those students having an interest in applying for the grant should contact the UCOM Chairman for further information and guidance. The biography of Mr. McMurray's outstanding contributions to the uranium industry in the U.S. and overseas is presented (here).

Committee Publications

The Uranium Committee's contribution to the ***AAPG Memoir 101: The History and Path Forward of the Human Species into the Future: Energy Minerals in the Solar System,*** *as* the final Chapter 9: *Nuclear Power and Associated Environmental Issues in the Transition of Exploration and Mining on Earth to the Development of Off-World Natural Resources in the 21st Century* has been released as a text. For the Memoir 101's Press Release, Table of Contents, ordering information, and Book Preface with Front Book Cover, see (here). Chapter 9 in the updated and revised form is presented in PDF format (here), along with author biographies.

The EMD co-sponsored *Natural Resources Research* will publish the bi-annual Unconventional Energy Resources: 2013 Review in late December or January, 2014 (more). The UCOM 2013 contribution this year is titled: *Uranium, Thorium, and Associated Rare Earth Elements of Industrial Interest.* For the 2011 Review (here); 2009 (here); and 2007 (here).

Executive Summary

- U.S. and worldwide nuclear plants continue to operate and expand under improved safety considerations as a result of the Japanese earthquake and tsunami.

- 70 new reactors are under construction in 13 countries, most of which in the Asian region. An additional 160 sites are in development.

- Significant further upgrading of nuclear reactor output is still being created in the U.S. by advanced engineering.

- U.S. production of uranium for the 2nd Quarter, 2013 was up 22% from the previous quarter, the highest since 1996.

- Expenditures in the uranium industry for land, exploration, drilling, production, and reclamation were 353 million or 111% more in 2012 than in 2011.

- Exploration drilling was up 24% in 2012 compared to 2011.

- During 2012, 11 uranium mines operated in Texas, Wyoming, and Nebraska.

- Seven new ISL plants are planned in New Mexico, South Dakota, Texas, and Wyoming for initiation of production years as the price rises.

- U.S. reactor demand for uranium in 2013 was projected to be 50 million pounds U_3O_8.

- Uranium prices still at low levels but are expected to rise in 2014.

- New laboratory methods have been developed to provide forensic information on the origin of uranium ore and produced yellowcake for use by law-enforcement officials to assess and identify the source of smuggled nuclear materials.

- Industrial research is expanding widely on plant-related geotechnical engineering issues such as metal fatigue from radiation exposure and on related issues.

- Small nuclear reactors continue to gain interest from U.S. and overseas companies.

- Environmental issues are under review concerning actual impact of radiation on humans.

- The US. FDA indicates that there are no Fukushima-related radionuclides present at harmful levels in food supplies from the Japanese-imported sources sold in the U.S.

- Yucca Test Sites in Nevada may yet re-emerge as a storage site for nuclear waste.

- The New Mexico WIPP site will likely remain open through at least 2050 to store transuranic waste from research and production of nuclear weapons.

- The State of Vermont is going to ask Texas to honor a 20-year agreement to host a low-level radioactive waste facility that remains unbuilt today.

- This report provides a special look at the U.S. operations of Energy Fuels, Inc. in New Mexico, Wyoming, Arizona, Utah, and Colorado.

- This report also provides a special look at the U.S. operations of Uranium Energy Corp. in Texas.

- The development of Virginia Uranium Mining's world-class uranium deposit containing 119-million pounds U_3O_8 in Pittsylvania County, Virginia remains uncertain, but proponents seem to be gaining ground on the basis that the operation would provide new jobs, generate significant revenue, and on the assurances of appropriate safety provisions incorporated into the design of the mine and handling and storage of its waste products to protect the area's groundwater. However, Governor-elect Terry McAuliffe stated in January (2014) that he will veto any legislation that facilitates uranium mining in the State of Virginia.

- In the U.S., NX Capital and its subsidiary Montrose Energy Group acquires mining properties in Utah and plans to acquire others in Western U.S.

- Black Range Minerals is buying the mothballed Shoottaring Canyon uranium mill in Utah from Uranium One.

- PowerTech's South Dakota mining operations are on hold until local and State reviews have been completed.

- Vancouver-based Anfield Resources has acquired 26 mining claim groups containing 133 unpatented BLM mining claims in Utah and Arizona.

- Canada has signed a comprehensive trade accord. The first with the European Union and a G8 country. This will likely create new markets access between Canada and the EU.

- Saskatchewan has made its first shipment of uranium (yellowcake) to China, who has 28 new nuclear reactors currently under construction and more than 120 in development.

- Cameco, a Saskatoon-based uranium company, as one of the largest uranium producers in the world, will benefit from the new arrangement with China as will other Canadian uranium mining companies.

- The Patterson Lake region, located in the Saskatchewan's Athabasca Basin, has become a major center of successful exploration and development of world-class uranium deposits.

- Greenland Government clears the regulatory way for development of new uranium and rare earth discoveries made recently and other to be made as the glaciers and snowpack continues to melt exposing bedrock for exploration.

- Mongolia has become an important source of uranium and rare earths.

- This report also provides a special look at the Russian Rosaton – Uranium One, Inc acquisition.

- The U.S.-Russian agreement to downblend weapons-grade uranium from Russian warheads will expire in late November, 2013.

- A total of about 500 tonnes of Russian weapons grade highly enriched uranium (equivalent to 20,000 warheads) have been downgraded into low-level enriched uranium used in U.S. nuclear reactors over the past 20 years, which has contributed to low uranium prices. The so-called 'Megatons-to-Megawatts' program has generated a total revenue of some US$ 13 billion to the Russian federal government.

- In addition to Canada's continuing discoveries of significant uranium deposits, Australia also continues to expand its uranium resource base, especially in Western Australia, South Australia and Northern Territory. Queensland will likely begin to report new discoveries now that their ban has been lifted.

- African countries are initiating or expanding on uranium exploration and mining projects in preparation for the rise in uranium prices in the next few years; they include: Algeria, South Africa, Botswana, Central African Republic, Chad, Democratic Republic of Congo, Gabon, Guinea, Malawi, Mali, Mauritania, Morocco, Namibia, Niger, Tanzania, Zambia, and Zimbabwe, and Chad, in West and Central Africa.

- Turkey and India are also increasing uranium exploration and development. India also has a world-class deposit of thorium.

- TerraPower, a Bill Gates' company, is actively developing new technology using spent uranium and, more recently, new technology using thorium.

- China continues to evaluate thorium in new reactor designs.

- In the U.S., using thorium to power vehicles is being developed in concept, but for long-term considerations, gasoline-powered vehicles remain the primary interest of the American auto industry.

- U.S. House of Representatives has passed legislation that would encourage expedited permit approvals for rare earth exploration and production. The U.S. Senate is currently considering the bill.

- The rare earth industry is beginning to recover from the impact of low market prices and limited demand.

- China is preparing to initiate stockpiling of rare-earth products to keep prices up and the market constrained as long as possible.

- Countries other than China are gearing up exploration and/or production of rare earths, especially Canada, Australia, the U.S., and in particular, Namibia (see special look).

Nuclear Power Industry Activities of Note

Keith Johnson, in a recent Wall Street Journal article, writes that nuclear power seems to have it all but something is holding it back (more). Like renewables, it emits no greenhouse gases. Like coal, it is always on. Nuclear doesn't face the price volatility that natural gas does, and it actually has a far better safety record than the coal and oil and gas industries. For all of these reasons, plenty of countries, from China and India to the Middle East, are depending on nuclear energy to power their futures.

So why has nuclear power not expanded substantially in recent years in the U.S.? A forecast by the Energy Information Administration (EIA), for example, gives it only 3% of new capacity for electricity generation through 2040, the same as for much-maligned coal. However, there may be some political agendas showing through the EIA reports these days.

Cheap and abundant natural gas is partly to blame. Indeed, gas-fired power is expected to grow 20 times as fast as nuclear through 2040, as predicted by the EIA. The sluggish economy and increasing

energy efficiency are taking a toll as well, reducing growth in demand for more power and for more power plants in general.

But nuclear energy also faces challenges all its own, including high construction costs, safety concerns (albeit minor), waste handling (albeit doable) and the threat of proliferation (albeit not so much). Here's a closer look at these challenges, and at what their solutions might be.

Nuclear plants are just construction projects. They cost more and take longer to build than any other mainstream source of electricity primarily because of regulations. No plant has been built in the U.S. for more than 30 years. However, two reactors are now under construction in Georgia, and two more are being built in South Carolina. But the EIA estimates it would take six years. That's two to three times longer than to build a gas, coal, wind or solar plant but who cares if the end product results in a safe, reliable source of power?

The estimated capital costs of building nuclear power plants are $5,429 per kilowatt, before interest charges. That compares with $2,883 for coal, $3,718 for coal-gasification, and $5,138 for coal with carbon sequestration, the latter being a technology so expensive that industry says it isn't a viable option to meet new environmental standards. One answer may well be in smaller, modular reactors, from less than one-tenth to one-third the size of a traditional reactor, could speed construction, reduce costs and financial risk.

Small modular reactors (SMRs), as discussed later in this report, would be built using modular components made in factories and shipped by rail or truck to the site. Proponents indicate that the process would bring economies of scale to an industry where few have existed in the past, except, that is, in terms where direct energy costs of nuclear are known to be very low when compared to all other energy sources, except hydropower. In the meantime, once built, both small-scale and large-scale nuclear plants have benefits in terms of direct costs and safety (more). Both nuclear power plants and hydroelectric power plants are expensive to build, but are both highly economic and reliable in the long run.

Based on input from the Nuclear Energy Institute and other sources, below is a state-by-state review of important activities related to nuclear power systems in the U.S. and related items:

Arizona

Arizona Public Service may need to extend the planned down time of a reactor at its Palo Verde nuclear plant south of Phoenix to repair a small leak, company officials said. Contaminated water was released from the leak, which was discovered during an inspection after the reactor was shut down on October 5, 2013. The leak is not a threat to public health and safety (more).

California

The economies of San Luis Obispo and northern Santa Barbara counties in California get nearly $1 billion a year from PG&E's Diablo Canyon nuclear plant, according to a report from the Nuclear Energy Institute and Cal Poly's Orfalea College of Business. The study comes as San Luis Obispo is considering what the economic impact of an eventual shutdown of the plant would be. Pacific Gas & Electric's decision whether to pursue the relicensing of its Diablo Canyon nuclear plant in California will hinge on the cost of any federally required seismic retrofitting, officials said. PG&E has postponed its relicensing bid while it carries out seismic studies. "After the studies are complete, we'll study the data and make a decision on license renewal," said PG&E spokesman Tom Cuddy (more).

Georgia

Georgia Power's spending of $209 million on the Plant Vogtle expansion project in the second half of 2012 has received the Georgia Public Service Commission's approval. The regulator has so far approved $2.21 billion in capital costs for the project. Southern Co. and the Department of Energy are continuing discussions over an $8.3 billion loan guarantee for the development of new reactors at Plant Vogtle in Georgia.

Massachusetts

Entergy's Pilgrim nuclear plant in Massachusetts receives "excellent safety ratings" from U.S. nuclear regulators, the company said. The comments came as a response to former Japanese Prime Minister Naoto Kan, who questioned the safety of the facility because it has technology similar to that of the Fukushima Daiichi plant in Japan. "The plant is regularly examined to identify enhancements to make it even safer, including using lessons learned from Fukushima, and many have either been completed or are underway," Entergy said (more).

Nuclear companies are affected by the pricing mechanism that less reliable energy sources benefit from, observers say. While other energy sources are paid varying amounts as demand shifts throughout the day, and can adjust their output accordingly, nuclear energy is constant, and must put its energy on the grid regardless of market conditions. "[The] market design is flawed because it doesn't take a long-term look at the portfolio of assets," said Bill Mohl, president of wholesale electricity sales at Entergy (more).

Michigan

According to a recent News Briefing by the Nuclear Energy Institute (NEI-more), Entergy will continue to operate its Palisades nuclear plant in Michigan. The Obama administration has granted

$1.8 million to the University of Missouri to encourage the development of small modular reactors.

Minnesota

Xcel Energy said the costs associated with its upgrade project for the Monticello nuclear plant in Minnesota were prudent, after the project's expanded price tag was questioned. The utility spent $665 million on the project, more than double the original estimate, as it involved replacing filters, pumps and other equipment (more).

Mississippi

The Mississippi Energy Institute is focusing on the business opportunities in nuclear energy, said Patrick Sullivan, the group's president. "Consolidated fuel storage" should be the starting point for Mississippi, he said, but this would require major federal and state policy changes. "France took our recycling technology and made it work and has been doing it for 30 years," Sullivan said

New York

Former Nuclear Regulatory Commission Chairman Dale Klein criticized members of an anti-nuclear panel for seeking to compare a possible accident at Entergy's Indian Point nuclear plant in New York and its Pilgrim facility in Massachusetts to the Fukushima Daiichi incident in Japan. Such a comparison "is intellectually dishonest and resembles the classic fear mongering intended to create unnecessary anxiety," Klein said. The terrorism safety and security upgrades to U.S. nuclear facilities have improved their emergency capabilities, Klein added.

Entergy's Indian Point nuclear plant in New York supplies clean and safe electricity, proponents of the facility said. "Nearly $1 billion has been invested in Indian Point over the past decade, making it a world-class facility," said Jerry Kremer, chairman of the New York Affordable Reliable Electricity Alliance. "Indian Point makes the region a cleaner, safer place to live." (more).

Ohio

The installation of two new steam generators at the Davis-Besse nuclear plant in Ohio will happen during a spring refueling outage in 2014, plant operator FirstEnergy said. The replacement project is part of the company's plan to extend the facility's operations.

Pennsylvania

Exelon has resolved flooding concerns at its Three Mile Island Unit 1 in Pennsylvania that were identified last year by the Nuclear Regulatory Commission, the agency said. NRC inspectors found that flood seals were missing on couplings for electrical cable conduits at the facility, prompting the agency to give the plant a "white" violation. Plant officials used watertight material to seal the conduits, the NRC said.

South Carolina

Mele Associates will have until Sept. 26, 2014 to finalize a crucial assessment of the Department of Energy's mixed-oxide fuel project at the Savannah River Site in South Carolina. The study, which had a deadline of Sept. 26 of this year, covers the potential effects of the project to convert weapons-grade plutonium into fuel for commercial nuclear plants (more).

Duke Energy is moving forward with its proposed Lee nuclear plant in South Carolina, even after it decided to drop plans for new reactors at its Shearon Harris facility in North Carolina, said Mike Hughes, the company's North Carolina vice president for community relations. "We continue to believe nuclear has to be in the mix," Hughes said.

Texas

The chairman of the Texas Low-Level Radioactive Waste Disposal Compact Commission says the organization is going to honor a 20-year-old agreement that guarantees space for radioactive waste from Vermont in its Texas disposal facility. During a Wednesday meeting at the Vermont Statehouse, Commission Chairman Robert Wilson says the commission recognizes Vermont is a partner in the compact. In 1993 Vermont and Texas formed the compact. Under the agreement, Texas would host a low-level radioactive waste facility and Vermont would have a place to send some of the waste from its nuclear power plant. Vermont officials are looking for assurance there will be space in Texas for waste from the Vermont Yankee nuclear power plant, which is due to be shut down next year and the dismantling process begun (more).

Vermont

The Vermont State Nuclear Advisory Panel is expected to meet this week to tackle options for the decommissioning of Entergy's Vermont Yankee nuclear plant. The company said it plans to mothball the facility for a period of years before it is dismantled, but critics are concerned that such a long period could prevent the site's conversion for other uses and could create uncertainty about costs (more).

Nuclear Regulatory Commission

The Nuclear Regulatory Commission's Southeast region had the fewest low-level safety violations from 2000 to 2012, despite having the most reactors in the agency's regions, a Government Accountability Office report showed. The West region had the most violations over that period, despite having the fewest reactors, the report found. The variation might indicate that the regions don't have a uniform standard for interpreting rules, observers say.

The Nuclear Regulatory Commission should not expedite the transfer of used nuclear fuel from storage pools in nuclear plants into dry containers, per the agency staff recommendations. The plan, which was brought up in the aftermath of the Fukushima Daiichi incident in Japan by an NRC task force, would "neither provide a substantial increase in the overall protection of public health and safety nor sufficient safety benefit to warrant the expected implementation costs," staff said (more).

Small Modular Reactors

The future of the U.S. nuclear industry could depend on small modular reactors, observers say. "Smaller reactors could be cost-competitive because, since they're built in a factory, you can construct them more quickly and on a mass scale," said Doug Walters, vice president of regulatory affairs at the *Nuclear Energy Institute*. "That would allow for faster and more efficient assembly." (more).

While countries such as Japan and Germany are moving away from nuclear energy in the wake of the Fukushima reactor meltdown in 2011, the United States is taking a different tack. "The promise of nuclear power is clear," Energy Secretary Ernest Moniz said in July at a Senate Energy and Natural Resources Committee hearing, adding, "Nuclear power has an important role in President Obama's all-of-the-above approach to energy." For the White House, part of nuclear energy's promise comes in the form of scaled-down facilities called small modular reactors, or SMRs. The average U.S. nuclear reactor has an operating capacity of 1,000 megawatts or more; SMRs, by contrast, have a generating capacity of less than 300 megawatts. They have yet to be deployed on a commercial scale, but the administration is supporting this option as a way to diversify the nation's energy portfolio and rein in carbon emissions.

President Obama has placed the Energy Department at the helm of a $452 million public-private partnership to finance SMR construction. In November, DOE awarded a grant to U.S-based Babcock & Wilcox to create a 180-megawatt SMR in cooperation with the *Tennessee Valley Authority* and *Bechtel*. The reactor is slated to be up and running by 2022.

The Tennessee Valley Authority plans to develop up to four small modular reactors at its Clinch River site in Tennessee and has started permitting procedures for the project, said Dan Stout, the

company's senior manager for small modular reactor technology. The reactors each would generate 180 megawatts of power and would be situated underground, protecting them from terrorist attacks. Barring delays, TVA expects the first of its small reactors to come online by 2022, he said.

The Reasons for Small Reactors

Scientific documents that promote the development of small modular reactors were presented during a conference in South Carolina. "One paper assessed the security risks behind SMRs, and the other three focused on safety assessment," said Thomas Sanders, a lab director at the Savannah River National Laboratory (more).

First, there's the economic argument. SMRs would be cheaper than conventional reactors simply because they're smaller. This means less overhead for utility companies. The component parts of SMRs would be manufactured in factories as modules that could be shipped for on-site assembly. Supporters of the technology say this would also bring down costs, although not everyone agrees.

Proponents of the technology follow a different line of reasoning. "Smaller reactors could be cost-competitive because, since they're built in a factory, you can construct them more quickly and on a mass scale," said Doug Walters, vice president of regulatory affairs at the Nuclear Energy Institute, a pro-nuclear advocacy group. "That would allow for faster and more efficient assembly."

In addition, SMRs could be safer than the aging stock of U.S. nuclear power plants. This is because they'll feature passive design technology, built-in safety systems that rely on automated mechanisms within the reactor and would continue to function in the event of an emergency or a loss of electricity.

"Because SMRs are newer, they probably will be safer than the current generation of reactors in the same way that a 2013 Ford is safer than a 1973 Ford," said Michael Mariotte, the executive director of the nonprofit *Nuclear Information and Resource Service*, an anti-nuclear organization. "But there could be other safety concerns.... For example, some companies have been talking about cutting costs by using just one control room to run five to six reactors," he said. "When you get to the root cause of nuclear accidents, it's almost always due to human error, and if you have fewer people watching the reactors, there's a greater chance of problems."

While SMRs remain an unproven technology, DOE is continuing to look for companies to develop the technology and is expected to award additional matching grants in the coming months.

According to Charles Ebinger, a foreign policy senior fellow and the director of the Energy Security Initiative at the *Brookings Institution*, Obama sees this as a way to help advance his second-term climate agenda, given that nuclear power, over the life of a reactor, is a near-zero-emissions technology.

Peter Lyons, the Energy Department's assistant secretary for nuclear energy, echoed this sentiment. "Nuclear plants offer the opportunity to deploy clean-energy technology across the country," he said. "The president's plan isn't a focus on nuclear, but it is a recognition that nuclear is one of the few clean-energy options available other than renewables. It's certainly a piece of the puzzle." If SMRs take off, they could spur U.S. manufacturing and be shipped abroad, boosting exports. Keeping a hand in nuclear power could also benefit national security.

"I think from a global perspective it's best for the U.S. to stay a prominent player in the nuclear industry," said Darren Gale, vice president and project director of *Generation mPower, LLC*, a company formed between *Babcock & Wilcox* and *Bechtel* responsible for developing the company's SMR prototype with funding from DOE.

NEI Criticizes Report that Dismisses SMR Benefits

A report from the *Union of Concerned Scientists* claims that small modular reactors could be less cost-effective than their larger counterparts and could prompt a reduction in safety standards for nuclear plants. *The Nuclear Energy Institute* dismissed the report, calling it a "a pile of conjecture and speculation." NEI spokesman Steve Kerekes said the industry is working with the Nuclear Regulatory Commission "to define the regulatory requirements for small reactors." (more).

The U.S. Department of Energy is expected soon to announce the winner of a second round of funding for developers of small modular reactors, a new type of nuclear reactor that proponents say could rejuvenate the construction of nuclear plants.

The DOE had said in the official funding opportunity that it planned to notify recipients of the award by Sept. 17 (2013). But the agency is still working to determine a winner and wants to ensure it spends enough time to make the right decision, the DOE said. It has no estimate as to when the process will be complete.

The award recipients will get access to a fund of $452 million to help move a small modular reactor design through the licensing and regulatory process. Small modular reactors, or SMRs, are typically less than 300 MW and are intended to be mass-produced at factories, achieving economies of scale to reduce capital costs compared to larger, traditional reactors.

This is the second funding opportunity for SMRs from the DOE. In the first, *Generation mPower*, a joint venture between *Babcock & Wilcox Co*. and *Bechtel Corp*., emerged as the favored design. *Generation mPower* will match each dollar of funding from the DOE to work to deploy its SMR design by 2022, and the company recently indicated that it has already allocated more than $100 million to its SMR development program.

But in March the DOE said it would make another award, and several developers that applied for the first round, including *NuScale Power LLC*, *Westinghouse Electric Co. LLC* and *Holtec*

International, applied for the second as well. Any winners would split the award money with Generation mPower.

Westinghouse, which has a tentative agreement with *Ameren Corp*. subsidiary *Ameren Missouri* to eventually deploy its SMR design at the Callaway nuclear plant site, also is awaiting DOE approval (more). *Ameren Missouri* is known legally as *Union Electric Co*. (more). *NuScale* is owned by *Fluor Corp*.(more).

Tennessee Valley Authority President and CEO Bill Johnson touted the company's small modular reactor development project with *Babcock & Wilcox*. "One of the things that's happened across the country, and here, is reduction or flattening of demand, so the idea that you can add generation or resources in smaller increments, instead of the large increments, that's attractive," he said. The project's export capability is also an advantage, Johnson added.

Environmental Issues

The *National Academy of Sciences* is preparing for a $2 million cancer-risk study that would cover six nuclear energy facilities. The assessment, which seeks to update data on cancer risks for people living near nuclear facilities and other related enterprises, is expected to take at least two years to finish, said Nuclear Regulatory Commission spokesman Neil Sheehan

The Department of Energy's DUF6 project, which employs about 200 people in Paducah, has doubled its production from 2012. The plant was originally designed to operate for up to 25 years, but is now expected to take anywhere from 18-30 years to convert the uranium enrichment at the gaseous diffusion plants. The DUF6 Project was initiated in 2011 to convert the nation's 800,000 metric ton inventory of depleted uranium hexafluoride (DUF6) to more benign forms for sale, ultimate disposal, or long-term storage.

The president of *Babcock and Wilcox Conversion Services, LCC* (BWCS) says that for the past 30 months, they have been "ramping up production and adjusting and modifying the plants and equipment to determine the rate that can be safely sustained in continuous operations... we will be adjusting systems to increase reliability and availability, which will account for the increased production."

Public Service Electric and Gas (PSEG) can purchase a stake in *Holtec International*'s small nuclear reactor project under a change in the agreement between the two companies (more). PSEG is also able to contribute to operations, training and other aspect of the project. "This agreement takes our relationship one step further, presenting exciting opportunities for our company and our employees, in addition to offering domestic development opportunities for our region. When the market for SMRs fully develops, I am pleased that PSEG will have a seat at the table," said William Levis, president and chief operating officer of PSEG Power.

Yucca Mountain

The revival of the Yucca Mountain repository in Nevada has drawn the support of *Nuclear Energy Institute* President and CEO Marvin Fertel. "The country has already spent about $10 billion on Yucca, and we believe it could still be an ideal setting for waste," Fertel said during the Edward Teller Lecture and Banquet. "Maybe the site for waste will be Yucca, and maybe it won't; but either way, we need contingencies." In the meantime, radioactive wastes are being shipped to the Nevada site starting in 2014. Despite questions and opposition from Nevada's governor and federal elected officials, the Federal Energy Department said in a press call that it would begin shipping 403 canisters of highly radioactive nuclear waste to Nevada for shallow burial about 65 miles north of Las Vegas at the Nevada National Security Site, formerly known as the Nevada Test Site (more).

Up to 100 shipments over the next few years will begin in early 2014 along undisclosed transportation routes between the canisters' current home in Oak Ridge, Tenn., and the Nevada National Security Site (more).

In August, a three-judge panel of the U.S. Circuit Court for the District of Columbia ruled (2-1) that the NRC acted improperly when it stopped the licensing review process for the facility. Work on the project and the licensing review processes were halted by President Obama in 2009. The court stated "unless and until Congress authoritatively says otherwise, or there are no appropriated funds remaining, the Nuclear Regulatory Commission must promptly continue with the legally mandated licensing process…the commission is simply defying a law enacted by Congress and the commission is doing so without any legal basis." The State of Nevada is appealing the ruling.

WIP Plant, Carlsbad

The Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico has a good chance of being in operation until 2055 because of continuing defense missions across America. WIPP is America's only deep geologic repository for transuranic waste from research and production of nuclear weapons. It employs about 1,000 people (more).

Farok Sharif, president and project manager of WIPP through the Nuclear Waste Partnership, said necessity probably would keep it open for a quarter-century longer than its projected shutdown date of 2030. He said WIPP now receives 17 to 19 shipments each week of transuranic waste from sites around the country. They include Los Alamos National Laboratory in New Mexico and installations in Idaho, Illinois and South Carolina.

Because labs and other defense operations will continue to produce transuranic radioactive waste, WIPP will remain a plant with a purpose, they said (more).

Update on Fukushima

There are no indications that radionuclides from the Fukushima Daiichi nuclear plant in Japan are present at harmful levels in food supplies in the U.S., according to the Food and Drug Administration (more). This comes as contaminated water from the facility continues to leak into the Pacific Ocean. Consumers aren't advised to change their intake of Japanese-imported food, the FDA said.

Radiation from the Fukushima Nuclear Plant in Japan continues to leak into the Pacific Ocean raising concerns that seafood is being contaminated. However, the Food and Drug Administration reports that so far there is no evidence that radionuclides from the Fukushima incident are present in the U.S. food supply at levels that would pose a public health concern.

In an update issued earlier this month the FDA stressed that they are not advising consumers to alter their consumption of specific foods imported from Japan or domestically produced seafood (more). The Fukushima Nuclear Plant was severely damaged during the massive earthquake that stuck Japan in March of 2011. A study published last month by the Center of Excellence for Climate System Science in Australia predicted that a radioactive ocean plume from the Fukushima disaster will reach the shores of the United States as soon as next year.

However, the report's authors caution that the concentration of radioactive material will be below the safety levels established by the World Health Organization. However, Japanese officials confirm that over 71,000 gallons of radioactive water is still leaking into the Pacific from the crippled nuclear power plant every day (more).

Fukushima Daiichi Nuclear Power Plant

The decommissioning of *Tokyo Electric Power*'s Fukushima Daiichi nuclear plant in Japan is more complicated than the Three Mile Island facility in Pennsylvania, said Lake Barrett, a former Nuclear Regulatory Commission official who was appointed as an adviser to TEPCO. Barrett, who

formerly led the cleanup at Three Mile Island, said the radiation leaks and the meltdowns in three Fukushima Daiichi reactors complicate the process.

Building Confidence in Nuclear Power

The developing world sees nuclear power as a must for electrical power generation and countries like China, Russia, India, South Korea and even some of the oil rich Arab countries have a very robust nuclear power plant development program underway. The United Arab Emirates (UAE) has plans for building nuclear reactors, which sends an important signal to the market. Even Saudi Arabia is building twenty. As one of the most oil-rich countries in the world, it could probably power itself with oil, yet is looking to diversify into nuclear. We think that's a very strong signal of the importance of nuclear power generation to even a country that produces oil extremely inexpensively relative to the rest of the world.

The *World Nuclear Association* sees increases in capacity coming from four fronts:

1. Nuclear power capacity worldwide is increasing steadily, with nearly 70 reactors under construction in 13 countries.
2. Most reactors on order or planned are in the Asian region, though there are major plans for new units in the USA and Russia.
3. Significant further capacity is being created by plant upgrading.
4. Plant life extension programs are maintaining capacity, in the U.S. particularly.

In total there are currently 435 operational nuclear plants in the world that provide nearly 20% of the world's electrical power. In addition to this there are currently almost 70 plants under construction as listed in the chart below and another 160 in development:

Commercial Operation*	Country	REACTOR	TYPE	MWe (net)
2013	Iran, AEOI	Bushehr 1*	PWR	950
2013	India, NPCIL	Kudankulam 1	PWR	950
2013	India, NPCIL	Kudankulam 2	PWR	950
2013	China, CGNPC	Hongyanhe 1*	PWR	1080
2013	China, CGNPC	Ningde 1*	PWR	1080
2013	Korea, KHNP	Shin Wolsong 2	PWR	1000
2013	Korea, KHNP	Shin-Kori 3	PWR	1350
2013	Russia, Rosenergoatom	Leningrad II-1	PWR	1070
2013	Argentina, CNEA	Atucha 2	PHWR	692
2013	China, CGNPC	Ningde 2	PWR	1080
2013	China, CGNPC	Yangjiang 1	PWR	1080
2013	China, CGNPC	Taishan 1	PWR	1700

2013	China, CNNC	Fangjiashan 1	PWR	1080
2013	China, CNNC	Fuqing 1	PWR	1080
2013	China, CGNPC	Hongyanhe 2	PWR	1080
2014	Russia, Rosenergoatom	Novovoronezh II-1	PWR	1070
2015	Russia, Rosenergoatom	Rostov 3	PWR	1070
2014	Slovakia, SE	Mochovce 3	PWR	440
2014	Slovakia, SE	Mochovce 4	PWR	440
2014	Taiwan Power	Lungmen 1	ABWR	1300
2014	China, CNNC	Sanmen 1	PWR	1250
2014	China, CPI	Haiyang 1	PWR	1250
2014	China, CGNPC	Ningde 3	PWR	1080
2014	China, CGNPC	Hongyanhe 3	PWR	1080
2014	China, CGNPC	Yangjiang 2	PWR	1080
2014	China, CGNPC	Taishan 2	PWR	1700
2014	China, CNNC	Fangjiashan 2	PWR	1080
2014	China, CNNC	Fuqing 2	PWR	1080
2014	Korea, KHNP	Shin-Kori 4	PWR	1350
2014?	Japan, Chugoku	Shimane 3	ABWR	1375
2014	India, Bhavini	Kalpakkam	FBR	470
2014	Russia, Rosenergoatom	Beloyarsk 4	FNR	750
2015	USA, TVA	Watts Bar 2	PWR	1180
2015	Taiwan Power	Lungmen 2	ABWR	1300
2015	China, CNNC	Sanmen 2	PWR	1250
2015	China, CGNPC	Hongyanhe 4	PWR	1080
2015	China, CGNPC	Yangjiang 3	PWR	1080
2015	China, CGNPC	Ningde 4	PWR	1080
2015	China, CGNPC	Fangchenggang 1	PWR	1080
2015	China, CNNC	Changjiang 1	PWR	650
2015	China, CNNC	Changjiang 2	PWR	650
2015	China, CNNC	Fuqing 3	PWR	1080
2015	India, NPCIL	Kakrapar 3	PHWR	640
2015?	Japan, EPDC/J Power	Ohma 1	ABWR	1350
2016	Finland, TVO	Olkilouto 3	PWR	1600
2016	France, EdF	Flamanville 3	PWR	1600
2016	Russia, Rosenergoatom	Novovoronezh II-2	PWR	1070

2016	Russia, Rosenergoatom	Leningrad II-2	PWR	1200
2016	Russia, Rosenergoatom	Vilyuchinsk	PWR x 2	70
2016	India, NPCIL	Kakrapar 4	PHWR	640
2016	India, NPCIL	Rajasthan 7	PHWR	640
2016	Pakistan, PAEC	Chashma 3	PWR	300
2016	China, China Huaneng	Shidaowan	HTR	200
2016	China, CPI	Haiyang 2	PWR	1250
2016	China, CGNPC	Yangjiang 4	PWR	1080
2016	China, CGNPC	Hongyanhe 5	PWR	1080
2015	China, CNNC	Hongshiding 1	PWR	1080
2015	China, CGNPC	Fangchenggang 2	PWR	1080
2016	China,	several others	PWR	
2017	USA, Southern	Vogtle 3	PWR	1200
2017	Russia, Rosenergoatom	Baltic 1	PWR	1200
2017	Russia, Rosenergoatom	Rostov 4	PWR	1200
2017	Russia, Rosenergoatom	Leningrad II-3	PWR	1200
2017	Ukraine, Energoatom	Khmelnitsky 3	PWR	1000
2017	Korea, KHNP	Shin-Ulchin 1	PWR	1350
2017	India, NPCIL	Rajasthan 8	PHWR	640
2017	Romania, SNN	Cernavoda 3	PHWR	655
2017?	Japan, JAPC	Tsuruga 3	APWR	1538
2017	Pakistan, PAEC	Chashma 4	PWR	300
2017	USA, SCEG	Summer 2	PWR	1200
2017	China,	several		
2018	Korea, KHNP	Shin-Ulchin 2	PWR	1350

Chicago Bridge & Iron and China Power Investment's Power Engineering have established a joint venture covering the construction of nuclear plants in China. Under the terms, CB&I will provide construction management, engineering, commissioning and technical support services for the reactors (more).

STATUS OF U.S. URANIUM INDUSTRY

2nd Quarter 2013 Statistics

U.S. Energy Information Administration (EIA) (2013) reported on U.S. production of uranium in the second quarter 2013 was 1,394,232 pounds U_3O_8, up 22 percent from the previous quarter and up 31 percent from the second quarter 2012. Second quarter 2013 uranium production is at its highest level since 1996. During the second quarter 2013, U.S. uranium was produced at six U.S. uranium facilities. For a Glossary of nuclear terms, see (more).

U.S. URANIUM MILL IN PRODUCTION (STATE)

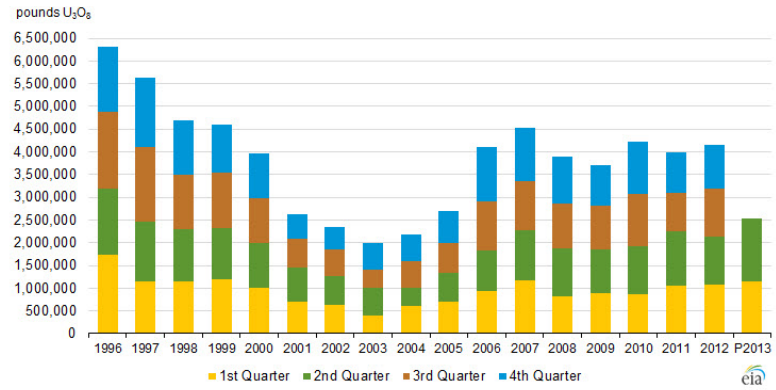
1. White Mesa Mill (Utah)

U.S. URANIUM IN-SITU-LEACH PLANTS IN PRODUCTION

1. Alta Mesa Project (Texas)
2. Crow Butte Operation (Nebraska)
3. Hobson ISR Plant/La Palangana (Texas)
4. Smith Ranch-Highland Operation (Wyoming)
5. Willow Creek Project (Wyoming)

For the first half of 2013, U.S. uranium concentrate production totaled 2,541,263 pounds. This amount is 19 percent higher than the 2,139,693 pounds produced during the first half of 2012.

Figure 1. Uranium concentrate production in the United States, 1996 - 2nd Quarter 2013



P = Preliminary data.
Source: U.S. Energy Information Administration: Form EIA-851A and Form EIA-851Q, "Domestic Uranium Production Report."

DRILLING STATISTICS IN URANIUM EXPLORATION

U.S. uranium exploration drilling was 5,112 holes covering 3.4 million feet in 2012. Development drilling was 5,970 holes and 3.7 million feet. Combined, total uranium drilling was 11,082 holes covering 7.2 million feet, 5 percent more holes than in 2011. Expenditures for uranium drilling in the United States were $67 million in 2012, an increase of 24 percent compared with 2011.

MINING, PRODUCTION, SHIPMENTS, AND SALES

U.S. uranium mines produced 4.3 million pounds U3O8 in 2012, 5 percent more than in 2011. Six underground mines produced uranium ore during 2012, one more than during 2011. Uranium ore from underground mines is stockpiled and shipped to a mill, to be milled into uranium concentrate (a yellow or brown powder). Additionally, five in-situ-leach (ISL) mining operations produced solutions containing uranium in 2012 that was processed into uranium concentrate at ISL plants.

Overall, there were 11 mines that operated during part or all of 2012. Total production of U.S. uranium concentrate in 2012 was 4.1 million pounds U_3O_8, 4 percent more than in 2011, from six facilities: one mill in Utah (White Mesa Mill) and five ISL plants (Alta Mesa Project, Crow Butte Operation, Hobson ISR Plant/La Palangana, Smith Ranch-Highland Operation, and Willow Creek Project). Nebraska, Texas and Wyoming produced uranium concentrate at the five ISL plants in 2012 (more).

FACILITY STATUS (MILLS AND IN-SITU-LEACH PLANTS)

At the end of 2012, the White Mesa mill in Utah was operating with a capacity of 2,000 short tons of ore per day. Shootaring Canyon Uranium Mill in Utah and Sweetwater Uranium Project in Wyoming were on standby with a total capacity of 3,750 short tons of ore per day. There is one mill (Piñon Ridge Mill) planned for Colorado.

At the end of 2012, five U.S. uranium ISL plants were operating with a combined capacity of 10.8 million pounds U_3O_8 per year (Crow Butte Operation in Nebraska; Alta Mesa Project, Hobson ISR Plant/La Palangana in Texas; Smith Ranch-Highland Operation and Willow Creek Project in Wyoming). Kingsville Dome and Rosita ISL plants in Texas were on standby with a total capacity of 2.0 million pounds U_3O_8 per year. Lost Creek Project and Nichols Ranch ISR Project were under construction in Wyoming. There are seven ISL plants planned in New Mexico, South Dakota, Texas, and Wyoming.

MINING, PRODUCTION, SHIPMENTS, AND YELLOWCAKE SALES STATISTICS

EIA has added new information in Table 4 and Table 5 that now include County and State location of existing and planned mills and in-situ-leach (ISL) plants. EIA (2012) produced their final report on 2012.

U.S. uranium mines produced 4.2 million pounds U_3O_8 in 2012, some 200,000 pounds more than 2011, from 10 mines (underground and in-situ-leach) and one other source. Five underground mines produced ore containing uranium during 2011, one more than during 2010. Uranium ore is stockpiled and shipped to a mill, to be milled into uranium concentrate (a yellow or brown powder). Additionally, five ISL mining operations produced solutions containing uranium in 2011 that was processed into uranium concentrate at ISL plants. An indication that the nuclear industry is anticipating price increases for yellowcake is presented in the marketing report for 2011, which was released in May, 2013 (see here). The marketing report for 2012 was released in May, 2013 (more).

The uranium production in the U.S. in the third quarter of 2013 increased 12% to 1,171,278 pounds, compared to 1,048,018 pounds in the same period the previous year, according to the EIA. This represents the highest Q3 level since 1999. Production during the third quarter, however, decreased 16% compared to the second quarter of 2013, which saw a production of 1,394,232 pounds. The third quarter production was 2% higher than the first-quarter amount.

For the first nine months of 2013, U.S. uranium concentrate production increased 16% to 3,712,541 pounds, as compared to 3,187,711 pounds produced in the first nine months of 2012. It is the highest first-three-quarters production level since 1997, when 4,101,513 pounds were produced, according to the report. The agency expects the U.S. reactors' uranium demand to total 50 million pounds (U_3O_8) in 2013 (more).

Yellowcake Forensics and Security

A team of Lawrence Livermore National Laboratory (LLNL) researchers has pioneered the use of a long-standing technology, near-infrared spectrometry, for analyzing the chemical composition and determining the origin of uranium samples. In a paper published as the cover story in the September edition of *Applied Spectroscopy*, the Laboratory scientists describe the first reported use of near-infrared spectrometry to study the chemical properties of uranium ore concentrates (UOC), also called yellowcake.

Yellowcake (also called urania) is a uranium concentrate powder obtained from leach solutions, in an intermediate step in the processing of uranium ores. Yellowcake concentrates are prepared by various extraction and refining methods, depending on the types of ores. Typically, yellowcakes are obtained through the milling and chemical processing of uranium ore forming a coarse powder

which has a pungent odor, is insoluble in water and contains about 80% uranium oxide, which melts at approximately 2878 °C (5212.4 °F).

Near-infrared spectrometers were first used in industrial applications in the 1950s and have been utilized for medical diagnostics, combustion research, pharmaceuticals and other uses, but not for studying uranium ore concentrates. The instrument measures the color, intensity and wavelength of light or reflected light.

It is believed that this technology could rapidly provide information on the origin of uranium samples to law enforcement officials who interdict smuggled materials and could be useful in preventing future trafficking from those sources.

For years, one of the primary methods used for determining the different types of uranium has been a simple visual color inspection by researchers. However, visual determination is subjective and no chemical information is provided (more).

Uranium Purchases and Prices

Owners and operators of U.S. civilian nuclear power reactors ("civilian owner/operators" or "COOs") purchased a total of 58 million pounds U_3O_8 (equivalent definition[1]) of deliveries from U.S. suppliers and foreign suppliers during 2012, at a weighted-average price of $54.99 per pound U_3O_8e. The 2012 total of 58 million pounds U_3O_8 increased 5 percent compared with the 2011 total of 55 million pounds U_3O_8. The 2012 weighted-average price of $54.99 per pound U_3O_8 increased 442 percent compared with the 2001 weighted-average price of $10.15 per pound U_3O_8, the lowest weighted-average price from 1994-2012.

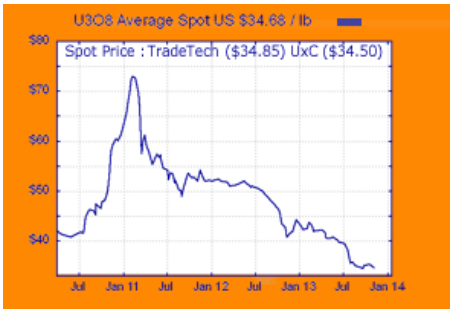
Seventeen percent of the U_3O_8 delivered in 2012 was U.S.-origin uranium at a weighted-average price of $59.44 per pound. Foreign-origin uranium accounted for the remaining 83 percent of deliveries at a weighted-average price of $54.07 per pound. Australian-origin and Canadian-origin uranium together accounted for 35 percent of the 58 million pounds. Uranium originating in Kazakhstan, Russia and Uzbekistan accounted for 29 percent and the remaining 19 percent originated from Brazil, China, Malawi, Namibia, Niger, South Africa, and Ukraine. Owners and operators of U.S. civilian nuclear power reactors purchased uranium for 2012 deliveries from 32 sellers, the same number as in 2011.

COOs purchased uranium of three material types. Uranium concentrate was 50 percent of the deliveries in 2012 and natural and enriched UF_6 were 50 percent. During 2012, 14 percent of the uranium was purchased under spot contracts at a weighted-average price of $51.04 per pound. The remaining 86 percent was purchased under long-term contracts at a weighted-average price of $55.65 per pound. Spot contracts are contracts with a one-time uranium delivery (usually) for the entire contract and the delivery is to occur within one year of contract execution (signed date).

Long-term contracts are contracts with one or more uranium deliveries to occur after a year following the contract execution and as such may reflect some agreements of short and medium terms as well as longer terms.

In terms of new and future uranium contracts in 2012, COOs signed 34 new purchase contracts with deliveries in 2012 of 12 million pounds U_3O_8 at a weighted-average price of $55.16 per pound. Thirty one were new spot contracts and three were new long-term contracts.

After the Fukushima disaster, Japan shut down 50 of its nuclear reactors, keeping uranium prices depressed (more). Uranium reached a high of $136 a pound in the summer of 2007. Japan is expected to restart some of the reactors and subsequently boost demand for the nuclear fuel. That along with the expiration of the U.S.-Russian Highly Enriched Uranium Agreement, which allows Russia to pull and sell uranium from Soviet-era nuclear warheads, is expected to underpin the price of uranium next year (more).



(update)

The end of the U.S.-Russia agreement is expected to remove about 24 million pounds of uranium concentrate from Western markets, according to Ms. Mohr.

The U.S. and Russia agreed to a new deal that sets the foundation for nuclear energy cooperation between the two countries. "This agreement supports President Obama's non-proliferation and climate priorities by providing a venue for scientific collaboration and relationship-building between the U.S. and Russian research and technical communities," Energy Secretary Ernest Moniz said. The countries could study the development of an international nuclear research hub, Moniz added (more).

The I2M Associates' Web Portal provides up to date articles and reviews of current and historical nuclear power activities (more).

EMPLOYMENT IN THE URANIUM INDUSTRY

Total employment in the U.S. uranium production industry was 1,196 person-years in 2012, an increase of less than one percent from the 2011 total. Exploration employment was 161 person-

years, a 23 percent decrease compared with 2011. Milling and processing employment was 394 person-years in 2012, and decreased 6 percent from 2011. Uranium mining employment was 462 person-years, the same as in 2011, while reclamation employment increased 75 percent to 179 person-years from 2011 to 2012. Uranium production industry employment for 2012 was in 11 States: Arizona, Colorado, Nebraska, New Mexico, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming.

EXPENDITURES IN THE URANIUM INDUSTRY

Total expenditures for land, exploration, drilling, production, and reclamation were $353 million in 2012, 11 percent more than in 2011. Expenditures for U.S. uranium production, including facility expenses, were the largest category of expenditures at $187 million in 2012 and were up by 11 percent from the 2011 level. Uranium exploration expenditures were $33 million and decreased 23 percent from 2011 to 2012. Expenditures for land were $17 million in 2012, a 14-percent decrease compared with 2011. Reclamation expenditures were $49 million, a 46-percent increase compared with 2011.

Vice-Chair Reports:

I. Uranium-Related Industry Activity

By Henry M. Wise, P.G. (Vice-Chair: Industry), SWS Services, LaPorte, TX

UNITED STATES ACTIVITIES

ARIZONA - UTAH – COLORADO – WYOMING – A Special Look At Energy Fuels Inc.

Energy Fuels Inc. is a Canadian uranium production and mining company with significant property holdings throughout the Western United States (more). The company has several producing (and standby) uranium and uranium-vanadium mines, with more development projects entering pre-feasibility and feasibility stages. It also boasts the only conventional uranium processing mill in the United States, which also has the capacity to extract uranium and other heavy metals from waste rock from third party producers, thereby enhancing the economic returns of the mill. Energy Fuels Inc. has several producing (and standby) uranium and uranium-vanadium mines throughout the Western United States, with more development projects entering pre-feasibility and feasibility stages.

The Company’s primary strategic asset is the White Mesa Mill, the only conventional uranium processing facility operating in the United States.

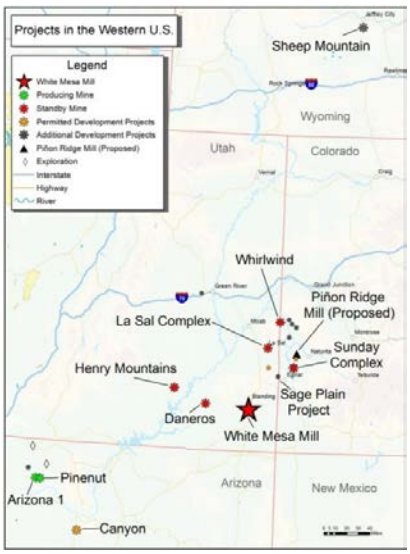
- The only conventional producer of uranium in the U.S. with expected FY-2013 production of 1.15m pounds U_3O_8
- One of the largest holders of NI 43-101 compliant uranium and vanadium resources in the U.S.
- Portfolio of operating and fully-developed mines in the Western U.S.
- Central Mill Supplied by Regional Mines
  - 1 Operating Mill
  - 2 Producing Mines
  - 5 Permitted Mines on Standby
  - 6 Permitted Development Projects
  - 23 Additional Development Projects

- The White Mesa Mill, located near Blanding, Utah, is the only conventional uranium mill in the U.S.
  - Licensed capacity: 2,000 tons of ore per day (8 million pounds of U_3O_8 per year)
  - Separate vanadium circuit
  - Separate alternate feed circuit for low-cost recovery of uranium from non-ore sources

- Recent acquisition of Strathmore Minerals Corp.
  - Roca Honda: One of the largest and highest-grade U_3O_8 deposits in the U.S.
  - Within trucking distance of the White Mesa Mill (250 miles)
  - Strengthened Industry Relationships with World Class Partners
  - Korea Electric Power Corporation (KEPCO) – Energy Fuels' largest shareholder and customer; seat on Energy Fuels' Board
  - Sumitomo Corporation – Strathmore's joint venture partner on the Roca Honda Project

- The White Mesa Mill is the only fully-licensed and operating conventional uranium mill (more).

Energy Fuels Inc Properties



(click to zoom)

The facility has a licensed capacity of 2,000 tons per day and can produce up to 8 million pounds of U_3O_8 per year. White Mesa also has a co-recovery circuit to produce vanadium from Colorado Plateau ores, and an alternate feed circuit to process other uranium-bearing materials, such as those derived from uranium conversion and other metal processing from third-party producers, thus enhancing the mills long-term economic viability.

White Mesa is strategically located in Blanding, Utah (above), central to the uranium and uranium/vanadium mines of the Four Corners region of the U. S. The mill was constructed in 1980 by Energy Fuels Nuclear Inc. In 2007, a $31 million modernization of the facility was completed (see photo below). The White Mesa Mill utilizes sulfuric acid leaching and a solvent extraction recovery process. The uranium produced is purchased by utility companies and shipped to conversion facilities as the next step in the production of fuel for nuclear power. The vanadium is shipped mostly to steel and alloy manufacturers (more).

Arizona 1 Mine

The Arizona 1 Mine is a producing uranium mine located in northern Arizona, approximately 35 miles south of the town of Fredonia, Arizona. The mine site for this high-grade "breccia pipe" deposit has less than 20 acres of total surface disturbance and is situated on land managed by the U.S. Bureau of Land Management (BLM). Originally approved by BLM in 1988, the Arizona 1 Mine has been in active production since late 2009, producing up to 300 tons of ore per day that is processed at Energy Fuels' White Mesa Mill. Through October 2012, Arizona 1 had mined a total of approximately 89,000 tons of ore, at an average grade of 0.62% U_3O_8, containing 1.1 million pounds of U_3O_8.

Mining at the Arizona 1 mine is expected to continue through the end of 2013, after which the resources will likely have been mined out. At this time, the mine will be scheduled for reclamation. The nearby Canyon and Pinenut properties will be evaluated to take advantage of existing infrastructure, and labor resources while the reclamation of the Arizona 1 property is undertaken; thereby leading to a potential seamless transition back into the region's uranium and vanadium production.

Pinenut Mine

The Pinenut Mine is a producing uranium mine located in northern Arizona, approximately 35 miles south of the town of Fredonia, Arizona. The mine site for this high-grade "breccia pipe" deposit has less than 20 acres of total surface disturbance and is situated on land managed by the BLM. Ore production at Pinenut Mine began in July 2013.

The potentially economic grade intercepts at the Pinenut deposit occur between depths from 880 feet to 1,370 feet below ground. According to a 2012 technical report, Inferred Mineral Resources at the Pinenut deposit are estimated to include 95,000 tons grading 0.54% U_3O_8 containing 1,037,000 pounds U_3O_8. Some high-grade mineralization was mined in the 1980s (~526,000 pounds U_3O_8), prior to Pinenut being placed on standby.

Canyon Mine

The Canyon Mine is a fully-permitted uranium mine located in northern Arizona approximately 6-miles south of Tusayan, Arizona. Energy Fuels is currently refurbishing and upgrading the existing infrastructure at the mine site, including a head-frame, hoist, and partially sunk shaft. Energy Fuels expects to begin ore production at the Canyon Mine in 2015. Shaft sinking is currently underway at the Canyon Mine and had reached a depth of about 250 feet in August 2013.

The Canyon deposit is essentially vertical with an average diameter of less than 200 ft., but it is considerably narrower through the distinct Coconino and Hermit horizons (80 ft.). The cross

sectional area is probably between 20,000 ft^2 and 25,000 ft^2. The pipe extends for at least 2,300 ft. from the Toroweap limestone to the upper Redwall horizons. The ultimate depth of the pipe is unknown.

Mineralization extends vertically both inside and outside the pipe over some 1,700 vertical feet, but ore grade mineralization has been found mainly in the Coconino, Hermit, and Esplanade horizons and at the margins of the pipe in fracture zones. Uranium mineralization at Canyon is concentrated in three stratigraphic levels: Coconono, Hermit/Esplanade, and a lower zone. Mineralization extends vertically from a depth of 600 ft. to over 2,100 ft. Intercepts range widely up to several tens of feet with grades in excess of 1.00% U_3O_8. Twenty-two drill holes from surface encountered uranium mineralization averaging 100 ft. of 0.45% U_3O_8.

According to a 2012 technical report, Inferred Mineral Resources at the Canyon mine are estimated to include 82,800 tons grading 0.98% U_3O_8 containing 1,629,000 pounds U_3O_8. All Mineral Resources were classified as Inferred given the drill hole spacing and orientation with respect to the continuity of the mineralization.

Sheep Mountain

The Sheep Mountain Project is located approximately eight miles south of Jeffrey City, Wyoming. It is comprised of 179 unpatented mining claims comprising approximately 3,205 acres and approximately 640 acres of State of Wyoming lease, and 630 acres of private lease lands. The combined land holdings comprise some 4,475 acres. The Sheep Mountain Project includes the Congo Pit (see photo below), a proposed open-pit development, and the reopening of the existing Sheep Mountain Underground mine.

Although alternatives were considered, the recommended uranium recovery method includes the processing of mined materials via an on-site, heap-leach facility. Permitting and licensing of the

project is well-advanced. A Plan of Operations was submitted to the BLM in June 2011, and the BLM is currently preparing an Environmental Impact Statement (EIS) for the project.

The Sheep Mountain Project contains approximately 12.9 million tons of measured and indicated resources at an average grade of 0.12% U_3O_8 (30.3 million pounds U_3O_8). Mining will be completed by both underground and open-pit methods. Mined product from the underground and open pit mine operations will be commingled at the stockpile site located near the underground portal and in proximity to the pit. At the stockpile the mine product will be graded, blended, and then conveyed via a covered overland conveyor system to the heap leach pad where it will be stacked on a double-lined pad for leaching.

Concentrated leach solution will be collected in a double lined collection pond and then transferred to the mineral processing facility for extraction and drying. The final product produced will be a uranium oxide, commonly referred to as “yellowcake”.

The currently planned mine life of the open pit is 15 years with an additional 5 years allotted for mine closure and reclamation. The estimated mine life of the underground operation is 11 years. The heap leach facility will be designed to accommodate both the mined material from the open pit and underground mine operations over the entire operating life of the two operations.

The preferred development sequencing of the Sheep Mountain Project is planned to be an open pit and underground conventional mine operation with on-site mineral processing featuring an acid heap leach and solvent extraction recovery facility. Development will begin with the operation of the open pit and heap leach facility and later bring the underground mine into operation 4-5 years later. This approach defers a substantial amount of initial capital, minimizes risk, and allows for a gradual startup of site activities while maximizing resource recovery. Additionally it optimizes fixed costs of both personnel and facilities.

The Sheep Mountain Project, if implemented, would be profitable under current economic conditions. Under the base case (preferred alternative and U.S. $65 per pound selling price) the project is estimated to generate an IRR of 35% before taxes and has an NPV of over US$118 million at a 10% discount rate.

The technical risks related to the project are low as the mining and recovery methods are proven. The mining methods recommended have been employed successfully at the project in the past. Risks related to permitting and licensing the project are also low as the project is a brown-field development located in a state which tends to favor mining and industrial development. The project has been well received locally, and will provide substantial revenues for Fremont County and the State of Wyoming, while providing much needed long-term employment for the region (more).

Acquisition of Strathmore Minerals Corp.

On August 28, 2013, **Energy Fuels** acquired **Strathmore Minerals Corp.** This acquisition has three primary rationales:

First, Strathmore's projects provide opportunities for major synergies with Energy Fuels projects. Strathmore's flagship project is the Roca Honda uranium project, located in New Mexico, a 60/40 joint venture with **Sumitomo Corporation of Japan**. Roca Honda is among the largest and highest-grade projects in the U.S. Strathmore's 60% share of Roca Honda boasts 1.2 million tons of measured and indicated uranium resources containing 10.1 million pounds. of U_3O_8 at grades that average 0.40%. Roca Honda also has another 0.9 million tons of inferred uranium resources containing 7.1 million pounds of U_3O_8 at grades that average 0.41%. Energy Fuels intends to evaluate processing Roca Honda ore at the White Mesa Mill, thereby avoiding the cost of constructing a new mill in New Mexico. In addition, Strathmore's Gas Hills Project in central Wyoming is only about 28-miles from Energy Fuels Sheep Mountain Project. The Gas Hills Project is a joint venture among Strathmore and **Korea Electric Power Corporation** ("KEPCO"). Energy Fuels intends to evaluate co-development scenarios for the Gas Hills and Sheep Mountain projects, thereby reducing development capital and achieving operating cost-savings.

Second, by acquiring Strathmore, Energy Fuels will further solidify its position as one of the largest holders of NI 43-101 uranium resources in the U.S. The combined company will hold 88.8 million pounds of measured and indicated uranium resources (at grades that range from 0.06% to 0.40% U_3O_8), in addition to another 38.2 million pounds of inferred uranium resources (at grades that range from 0.05% to 0.98% U_3O_8). This will place the company within a few million pounds of the largest resource holder, **Virginia Energy Resources** (of which Energy Fuels holds about a 16.5% interest).

Third, this transaction affords Energy Fuels the opportunity to further solidify its ties with KEPCO and Sumitomo. KEPCO is Energy Fuels largest shareholder and an affiliate of KEPCO is also Energy Fuels largest uranium customer (based on expected FY-2013 deliveries). Upon closing of the acquisition, Energy Fuels expects to appoint a director, nominated by KEPCO, to its Board of Directors. Energy Fuels also looks forward to expanding its relationship with Sumitomo (more).

SOUTH DAKOTA

The second of two state permit hearings on a proposed uranium mine in western South Dakota is this week in Rapid City (more). The state Water Management Board is deciding whether to approve permits for **Powertech Uranium Corp**.'s proposed Dewey-Burdock mine near Edgemont. The hearing was to be held earlier this month but was postponed because of a snowstorm.

The state Board of Minerals and Environment held a weeklong permit hearing on the project late last month. That board's decision is pending. That more than 200 people have signed up to speak at this week's hearing. Supporters of the proposed mine say it would create jobs and tax revenue. Opponents fear it will harm the environment (more).

TEXAS - A Special Look at Uranium Energy Corp

Uranium Energy Corp (UEC) is a U.S.-based uranium mining and exploration company focused on expanding uranium production using low cost in-situ recovery (ISR) while developing a pipeline of resources for major ongoing growth.

The Company has a portfolio of projects along the South Texas uranium belt, including Palangana, an ISR mine, which is ramping up production, and the soon-to-be completed Goliad ISR Project. The Company also owns and operates the Hobson Processing Plant, a key component in their "hub-and-spoke" production strategy.

UEC announced recently that it recently arranged funding that will support the growth of the Company's South Texas exploration projects, primarily the Burke Hollow ISR property and new acquisition opportunities (more).

Amir Adnani, President and CEO, stated: "We are very pleased to secure this capital injection for the Company on attractive terms that will support the growth of our South Texas hub-and-spoke strategy and provide us with greater financial flexibility. As the recently established $20 million credit facility is earmarked for our Palangana and Goliad projects, including working capital, this new funding will enable us to further our efforts at Burke Hollow and other exploration opportunities within hauling distance of our central Hobson processing facility. With the Hobson plant having a physical capacity of two million pounds per year processing, it is key that we advance the permitting and exploration of our projects to maximize the uranium output when higher uranium prices are realized." UEC activities are illustrated in the figure below:

Hobson Processing Plant

The fully licensed and permitted Hobson Processing Plant is central to all of its projects in South Texas. Fully operational, the Hobson Processing Plant is an in-situ recovery uranium processing plant, located approximately 160 kilometers northwest of Corpus Christi in Karnes County, Texas. Hobson was originally licensed and constructed in 1978, and was completely overhauled in 2008. The plant is designed to process uranium-loaded resins from satellite mines to a final product, U_3O_8.

By utilizing the Hobson Processing Plant as a central processing site (see below), the Company eliminates the need to construct a new processing plant on site at each project.

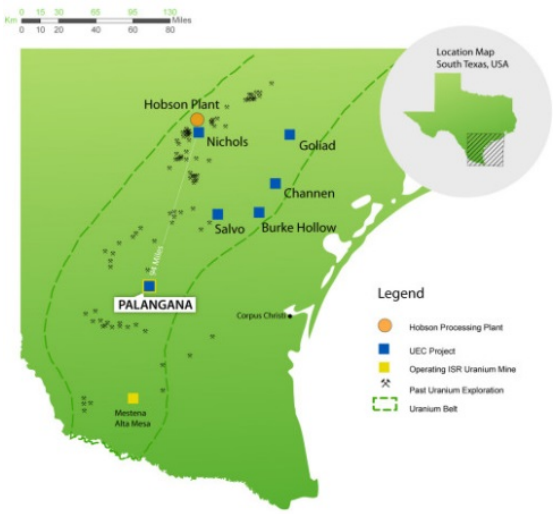
ISR Mining Technology

Uranium Energy Corp (UEC) has employed ISR mining technology at the Palangana uranium project. The ISR process is the most environmental friendly method of uranium mining, and is an injected-solution mining that reverses the natural process that first deposited the uranium in the sandstones (more). On-site ground water is fortified with gaseous oxygen and introduced to the uranium ore body through a pattern of injection wells. The solution dissolves the uranium from the sandstone host rock then the uranium-bearing solution is brought back to surface through production wells where the uranium is concentrated on resin beads for trucking to the Company's Hobson processing plant. Once at Hobson, the resin is stripped from the resin, concentrated and dried into yellowcake for market.

ISR mining generally requires lower capital and operating costs with shorter construction and permitting time lines compared to conventional mining methods.

The Palangana ISR Mine is located on the South Texas Uranium Belt, between San Antonio and Corpus Christi in Duval County. Access is excellent, with major two-lane roads connecting the three surrounding towns and secondary dirt roads connecting Palangana to these same towns.

Palangana Mine



NI 43-101 Resource Estimates for Palangana Mine

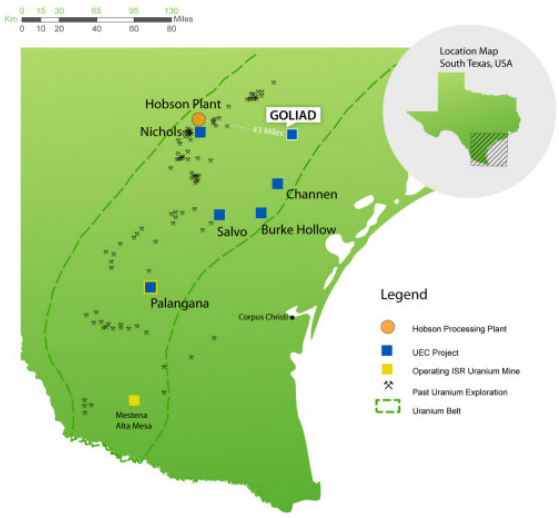
Resource Estimates – Palangana Mine				
Resource Category	**Cutoff GT**	**Tons**	**Grade % U_3O_8**	**Pounds U_3O_8***
M&I Resource	0.5	393,000	0.135	1,057,000
	0.5	328,000	0.176	1,154,000

* Disequilibrium Factors Applied
**GT – is grade-thickness determined by multiplying the grade of mineralization expressed in percentage terms by mineralized thickness measured in feet.

Since commencing production November 2011 the Company has brought online three different production areas. In addition, development and permitting continues on future Production Areas-4, 5, and 6. The Company expects to fulfill permitting requirements in the near future and bring these uranium resources into production. The Company has also increased its leased land holdings at the Palangana Mine area to identify and develop additional future uranium resources.

Palangana is located ~100 miles south of UEC's Hobson processing plant

Goliad Project



NI 43-101 Resource Estimates for Goliad

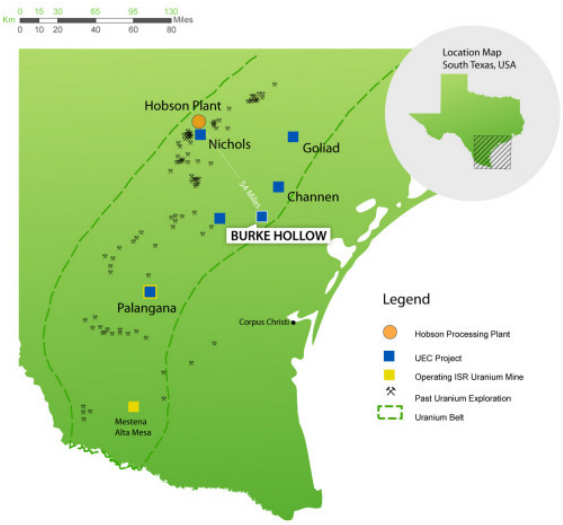
Resource Estimates – Goliad Project

Resource Category	Cutoff GT	Tons	Grade U_3O_8	%	Pounds U_3O_8*
M&I Resource	0.3	3,790,600	0.05		5,475,200
Inferred Resource	0.3	1,547,500	0.05		1,501,400

* Disequilibrium Factors Applied
**GT – is grade-thickness determined by multiplying the grade of mineralization expressed in percentage terms by mineralized thickness measured in feet.

The Goliad ISR Project is located in South Texas near the northeast end of the extensive South Texas Uranium belt. In December 2012, final regulatory authorization was received to initiate production at the now fully-permitted Goliad ISR Project. The project is under construction with a three-phase electrical power system and a large site pad having been completed. Procurement of processing equipment and supplies for the construction of the satellite facility and first production area are well underway.

Burke Hollow



NI 43-101 Resource Estimates for Burke Hollow

Resource Estimates – Burke Hollow

Resource Category	Cutoff GT	Tons	Grade % U_3O_8	Pounds U_3O_8*
Inferred Resource	0.5	3,029,000	0.05	2,890,000

* Disequilibrium Factors Applied
**GT – is grade-thickness determined by multiplying the grade of mineralization expressed in percentage terms by mineralized thickness measured in feet.

Uranium mineralization as defined by historic drilling remains open laterally in all directions, providing excellent potential targets for additional drilling and thereby increasing the size of the uranium resource. The mineralization is contained in four sand horizons from depths of 27 meters to 137 meters; and metallurgical testing has been independently reviewed with recovery rates of approximately 86% to 89%.

The Burke Hollow ISR Project is located along the Goliad trend within the prolific South Texas uranium belt, and approximately 50 miles southeast of the Company's Hobson uranium processing facility. It is on-trend geologically with several historic and two active in-situ recovery mines. Total Minerals conducted reconnaissance exploration drilling on the property in 1993, completing 12 exploration holes. Impressive mineralization was discovered in three Goliad sands, and additional shows were recorded in two other sands. 11 of 12 exploration holes displayed gamma-ray anomalies.

The project hosts an Exploration Target of total contained 1.8 to 7.2M pounds U_3O_8 at an average grade range of 0.03% to 0.06%. Permitting work has commenced and additional exploration and development drilling is planned with only 30% of the property drilled to date.

Exploration Target Summary:

	Tons	Grade % U_3O_8	Pounds
Lower Limit	3,000,000	0.03	1,800,000
Upper Limit	6,000,000	0.06	7,200,000

UEC is currently in production with its Palangana Mine. Its Goliad ISR Project is set to begin production in the near future. The Company also owns and operates the Hobson Processing Plant, a fully permitted facility that is central to UEC's South Texas operations. This "hub-and-spoke" strategy gives UEC a substantial advantage over competitors in the region. These cost efficiencies will also aid in the development of their substantial portfolio of projects in the South Texas Uranium belt.

UEC has numerous uranium projects at advanced stages, and should have a steady stream of drill ready targets to exploit. The Company is well-financed and positioned for future growth with the demand for uranium concentrate expected to rise.

UTAH

Vancouver-based **Anfield Resources** stock has jumped 40% recently after it announced that it has launched into the uranium field, acquiring 26 mining claim groups containing 133 unpatented

mining claims in the uranium-producing regions of San Juan County, Utah and Mohave County, Arizona from MAG Exploration Services Inc. to go along with its existing copper production.

Within each of the Utah districts of San Juan County there has been historical uranium production. Moreover, in some cases, the acquired properties themselves not only include past-producing uranium mines but also sit in proximity to currently producing uranium mines. Finally, all of the acquired assets within San Juan County, Utah are within a 75-mile radius of **Energy Fuels Inc**.'s White Mesa mill, the only operating conventional uranium mill in the U.S. (more).

White Canyon Uranium District

The acquisition includes seven claim groups and 22 individual claims situated in the White Canyon Uranium District in western San Juan County, Utah (more). The White Canyon Uranium District is estimated to have produced more than 11,000,000 pounds of U_3O_8, with an average grade of 0.24% U_3O_8. The District is also home to Energy Fuels Inc.'s Daneros Project, a current/recent Uranium producer, as well as the historically-producing Happy Jack mine.

Moab Uranium District

The acquisition includes five claim groups and 37 individual claims situated in the Moab Uranium District in northern San Juan County, Utah. The Moab Uranium District is located in the heart of the Paradox Basin, and produced an estimated 3,276,000 pounds U_3O_8 with an average U_3O_8 grade of 0.29% and 1.15% V_2O_5 One of the properties in the acquisition, the Yellow Circle, has been estimated to have had approximately 1,000,000 pounds of U_3O_8 in historic production.

Dry Valley Area

The acquisition includes five claim groups and 23 individual claims situated in the Dry Valley Area of the Monticello Uranium District in eastern San Juan County, Utah. Significant amounts of Uranium and Vanadium have been produced from the area. Total past production in this area is estimated at 1,525,000 pounds U_3O_8 and 12,662,000 pounds of V_2O_5, with an average U_3O_8 grade of 0.18% U_3O_8 and 1.35% V_2O_5 Significant past producers in the Dry Valley Area include the Frisco Twin Mine and the Geneva Mine.

Montezuma Canyon

The acquisition includes 8 claim groups consisting of 29 individual claims situated in the Montezuma Canyon Area of the Monticello Uranium District in eastern San Juan County, Utah. Total past production in this area is estimated at 88,000 pounds U_3O_8 and 775,000 pounds V_2O_5, with an average U_3O_8 grade of 0.24% and 0.31% V_2O_5.

Date Creek Basin

The Date Creek Basin (DCB) project consists of 24 unpatented mining claims situated in Mohave County, Arizona, about 110 miles southeast of Kingman, Arizona in the Date Creek Basin, which is a historic Uranium producing region. A number of companies explored the Date Creek Basin property and the immediate vicinity in the 1960s-1970s, including **Hecla Mining**, **Getty Oil**, **Homestake Mining**, and **Public Service Company of Oklahoma**, with a combined total of 443 exploration drill holes. The most recent exploration was conducted in 2007, resulting in 35 exploration drill holes. Production from the DCB was reported between 1955 and 1959 at 33,593 pounds U_3O_8 with an average grade of 0.16%. The past-producing Anderson Mine, currently owned by **Uranium Energy Corporation** (UEC), is located in DCB (more).

General Strategy

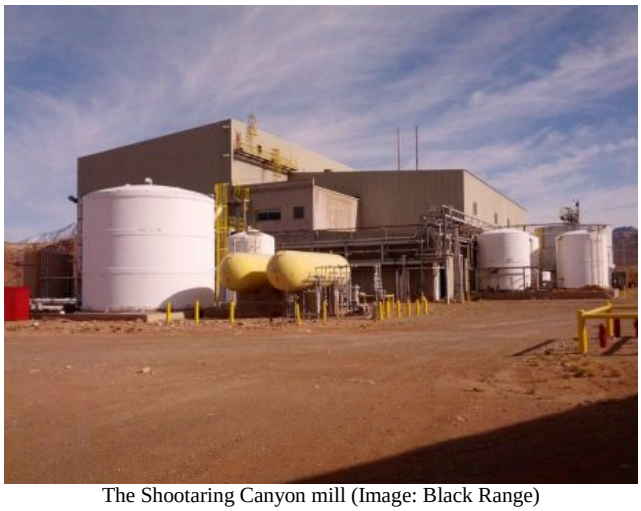
The strategy of **Anfield Resources** is to acquire strategic resource assets basis, which can generate near-term revenue and cash flow. They have concluded that these uranium assets (claims) fall within the purview of that strategic focus. They will be following the same approach that has proved successful at Anfield Resources' copper asset in Chile, where they provide raw material to a third-party processing plant, or mill, in exchange for a discounted price.

Typically, the biggest hurdles facing junior mining companies relate to the expense involved in finding a way to process their raw materials. Therefore, by acquiring resource assets in proximity to a functioning processing facility Anfield is able to avoid the hurdles facing the vast majority of junior mining companies. They have concluded that uranium mills will be looking for raw materials, especially given the impending expiration of the HEU agreement between Russia and the U.S. this month. This factor, combined with the number of nuclear reactors proposed, planned or under construction worldwide, point to a shortfall in uranium raw materials, and represents a tremendous opportunity for Anfield.

Other Companies in Utah

NX Capital and its wholly-owned subsidiary, **Montrose Energy Group** entered into a deal to acquire a uranium mining property in San Juan county, Utah. Under the terms of the agreement, Montrose Energy will own, develop and operate the property, as an exploratory mine. Colorado-based NX Capital aims to develop operations in the mining and energy industry in a number of western U.S. (more).

Black Range Minerals has agreed to buy the mothballed Shootaring Canyon uranium mill in Utah from Uranium One for $10 million. The acquisition includes surface stockpiles of uranium ore, with a historic mineral resource estimate of some 250,000 pounds U_3O_8 (97 tU) at a grade of 0.13% U_3O_8.



The Shootaring Canyon mill (Image: Black Range)

Black Range has also agreed to acquire **Uranium One**'s other "conventional mining assets" within the USA, the most advanced being the previously mined Velvet-Wood deposit in Utah with remaining NI43-101 estimated resources of 5.3 million pounds of U_3O_8 (2039 tU). Black Range already owns the Hansen/Taylor Ranch uranium project in Colorado. The company says that the cost of acquiring, refurbishing and restarting the Shootaring Canyon mill is expected to be "significantly less" than building a new processing facility at Hansen, and should enable it to fast-track the development of its Colorado project while avoiding costs from toll-milling at a third-party mill. The company is expected to customize the mill so it can preferentially receive high-grade concentrates from multiple projects across the U.S.

The Shootaring Canyon mill, located approximately 77 kilometers south of Hanksville, Utah, is permitted to process up to 750 tonnes of ore per day, but has a capacity to process 1,000 tonnes per day. The mill, the last conventional uranium mill to be built in the U.S., was commissioned and operated for just four months in 1982, before being mothballed due to declining uranium prices. Black Range estimates it would take about 18 months to acquire the necessary permits to bring the mill back into action. **Uranium One** originally acquired the Shootaring Canyon mill from **US Energy Corp** in April 2007 (more).

VIRGINIA

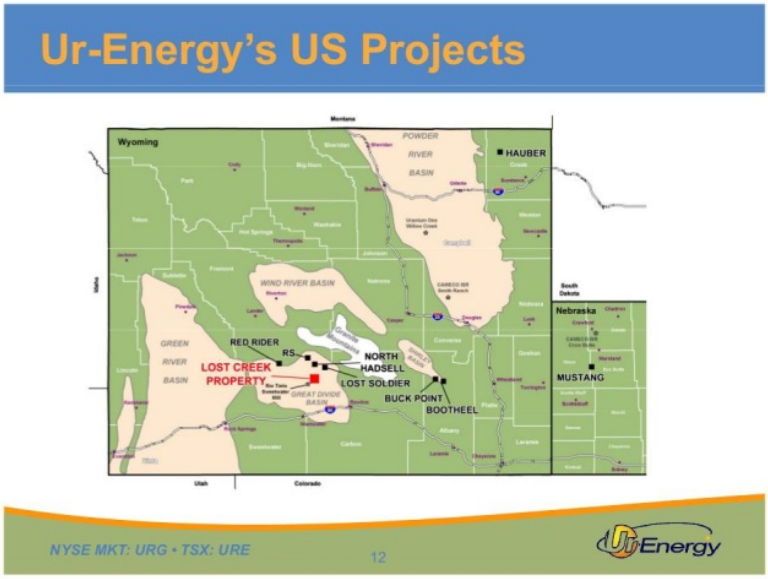
With uranium mining likely to re-emerge, Virginia's General Assembly, via a panel of experts, is scheduled to dissect the issue at a forum at Washington and Lee University. The Lexington panel discussion will feature Virginia Tech professor Robert Bodnar, an advocate of mining, and Cale Jaffe of the Southern Environmental Law Center. He has been a leading voice against uranium mining. The forum will also include a nuclear power industry representative, among others. However, However, Governor-elect Terry McAuliffe just stated that in January (2014) he will veto any legislation that facilitates uranium mining in the State of Virginia. He stated further that he was

not comfortable with the science to the point that he could say that with uranium mining, we would be safe. He said “I’m afraid it would get into the drinking water.” (more).

Virginia Uranium Mining Inc. plans to mine a 119-million-pound deposit of the uranium ore in Pittsylvania County. It says it can be done safely without contaminating the drinking water and create hundreds of jobs in a region that desperately needs them. Opponents say the substantial economic benefits of mining outweigh the minimal environmental threats (more).

WYOMING

UR-Energy (URG) is a Colorado-based junior uranium mining company that has become the first new producer of uranium fuel in the western U.S. in more than 25 years. This is significant from a strategic perspective in that the U.S. is a severe net importer of U_3O_8 producing only ~10% of its nuclear fuel needs from mines in the U.S. (more).



Reaching producer status should provide a valuation increase, especially since it's a low cost, in situ recovery (ISR) operation. Given that the U.S. requires about 50 million pounds of uranium and only produces 5 million pounds domestically, any incremental production in the U.S. should be valued at a premium in light of domestic security-of-supply considerations (more).

For additional information on exploration in the U.S., Canada, and elsewhere, see (here).

A Look into the Russian Rosatom - Uranium One Acquisition

The state-owned Russian nuclear energy company that built Iran's nuclear reactor in Bushehr is about to finalize a transaction that will give Russia absolute control over one of America's largest uranium mining sites. On Oct. 18 (2013), **Rosatom** completed a corporate agreement giving it 100 percent control over Canada-based uranium mining company **Uranium One, Inc.** including the company's U.S. operations in Wyoming, the epicenter of U.S. uranium production (more).

Moscow's acquisition of *Uranium One* will also provide Rosatom - the world's leading builder of nuclear power plants - with uranium exploration rights in Arizona, Colorado, and Utah (more).

Rosatom, which constructed Iran's Bushehr nuclear reactor just a few weeks ago, is not yet finished with its work in the Islamic Republic (more). Following a meeting between Russian President Vladimir Putin and Iranian President Hassan Rouhani in September, 2013, Iranian nuclear chief Ali Akbar Salehi announced that Tehran and Moscow will cooperate in the future construction of a second nuclear power plant at Bushehr, adding that "construction work is to start soon." (more).

Rosatom's nuclear projects also include ventures with China (more) and Venezuela (more), two countries with less-than-friendly relations with the U.S. Russian news agencies also quoted Syrian president Bashar al-Assad in May 2010 as saying that he discussed with then-Russian President Dmitry Medvedev the possibility of building nuclear power plants in Syria (more).

Questions abound regarding Rosatom's acquisition of *Uranium One*. When Rosatom acquired its first controlling shares in 2010, the deal came under congressional fire (more). Representatives Ileana Ros-Lehtinen (R-Fla), Spencer Bachus (R-Ala.), Peter King (R-N.Y.), and Buck McKeon (R-Calif.) penned a letter to then-Treasury Secretary Timothy Geithner warning that "signing over control of this U.S. uranium processing facility to the Russian government unnecessarily jeopardizes U.S. security interests." (more).

In the end, however, the sale of the initial majority stake in **Uranium One, Inc** was approved by the Committee on Foreign Investments in the United States (CFIUS) and the United States Nuclear Regulatory Commission (NRC). The NRC's only caveat was to prohibit *Uranium One* from exporting any of the produced material without prior approval (more).

The proposed transfer of 100 percent control of *Uranium One* to Rosatom has neither elicited a response from Congress or the Obama Administration, nor has it raised issues in Ottawa. In March (2013), Rosatom received approval from the Supreme Court of Ontario, Canada (more). And because Rosatom's new deal involves the same parties as the 2010 transaction, this action does not change the corporate structure of *Uranium One*, and does not alter Rosatom's already-held

majority control over *Uranium One*. Rosatom was able to bypass the need for additional approval by CFIUS and the NRC for the 2013 transaction (more).

Uranium One Inc. recently reported quarterly revenue of $220.8 million for Q3 2013, including joint venture revenue, based on sales of 6.0 million pounds at an average realized sales price of $37 per pound at an average total cash cost per pound sold of $16.

Uranium One Inc. also announced recently an update of the existing mineral resource and reserve estimates for its operations in Kazakhstan, the United States, Australia and Tanzania, including new and significantly increased mineral resource and reserve estimates for its Akbastau and Karatau uranium mines (more).

While the American regulatory regime is a trusted system, Russia has a history of transferring dangerous materials and technologies to rogue regimes, and Rosatom, according to a 2007 report on nuclear nonproliferation by the U.S. General Accounting Office (GAO), "denied [GAO's] request for access to facilities under its control." (more).

Uranium One, Inc in 2010 issued assurances that "none of the uranium produced in the US will be used by Rosatom to fuel the Iran reactor." (more). It is now crucial, in light of this new deal, that Rosatom provide additional guarantees that none of the uranium produced or revenue generated from its U.S. operations will be used for nuclear proliferation in Iran, China, Venezuela, Syria, or any other states on Rosatom's roster.

In the meantime, Congress and the Administration should look into whether Rosatom has engaged in any proliferation related to weapons of mass destruction, and thus be subject to sanctions, specifically Executive Order 13382, which sanctions persons engaged in weapons-related proliferation activities and their support networks (more).

As reported by Baker (more) of *Foundation for Defense of Democracies*, a Washington, D.C.-based policy institute focusing on national security, Senator John Barrasso (R-Wyo.) reaffirmed *Uranium One*'s commitment that it "has no plans to export Wyoming uranium to Russia, or any other country that may not share US interests." (more).

In 1993, the U.S. and Russian governments signed an agreement for the purchase over a 20-year period of 500 tonnes of Russian 'surplus' high-enriched uranium (HEU) from nuclear disarmament and military stockpiles. These were to be bought by the U.S. for use as fuel in civil nuclear reactors. Under the deal, the U.S. transferred to Russia a similar quantity of natural uranium to that used to downblend the HEU. The final shipment this year of low-enriched uranium (LEU) from TVEL's JSC Electrochemical Plant (ECP) marks the completion of Russia's commitments under the Megatons to Megawatts program. The U.S.-Russian agreement to downblend weapons-grade uranium will expire later this year (2013).

The ECP Plant and the 'Megatons to Megawatts' Program

The plant in Zelenogorsk in Russia's Krasnoyarsk Region was one of four enrichment plants contracted by Tenex to downblend the HEU. It has processed about one-third of the total HEU downblended under a contract signed with Tenex in 1996. ECP has also undertaken the re-enrichment of tails for the downblending, using about half of its capacity. Known as the HEU Agreement, and sometimes referred to as the 'Megatons to Megawatts' program, it was implemented through a 1994 contract between the U.S. Enrichment Corporation and Techsnabexport (Tenex), which acted as executive agents for the U.S. and Russian governments. After the HEU Agreement was signed the U.S. Enrichment Corporation was later privatized, becoming **USEC Inc**. Since 2000, the program has been under the U.S. National Nuclear Security Administration (NNSA).

Since the agreement was signed, 500 tonnes of Russian weapons-grade HEU - equivalent to 20,000 warheads - have now been downblended into 15,259 tonnes of LEU. On 21 August, the final shipment of LEU under this program departed the ECP plant by rail on route to St Petersburg. From there it will be shipped to the U.S.

Since 1996, U.S. experts have visited the ECP plant some 94 times. A U.S. delegation was present at the plant to witness the final shipment of LEU. They made their last visit to the plant in October to mark the end of the ‘Megatons to Megawatts’ program, which has provided about 10% of U.S. electricity over the past two decades.

Tenex has estimated that by the time the Megatons to Megawatts program expires by the end of 2013, it would have brought in total revenues of some $13 billion to Russia's federal budget (more).

Other Activities in the U.S.

The Nuclear Energy Institute (NEI) held its International Uranium Fuel Seminar (IUFS) in San Antonio, Texas in October, 2013. The Seminar provided a forum for nearly 200 nuclear industry professionals to convene and better understand the current and future state of the nuclear fuel cycle (more).

CANADIAN ACTIVITIES

In what is being heralded as a "new day" for Canada's uranium market, a comprehensive trade accord in draft could spell the end of restrictions on European investment in Canada. Canadian Prime Minister Stephen Harper has called the Comprehensive Economic and Trade Agreement (CETA) the "biggest, most ambitious trade agreement" that Canada has ever embarked upon. It is

also the first time a free trade agreement has been laid out between the European Union (EU) and a G8 country (more).

CETA will create new market access between Canada and the EU, at the same time removing 99 percent of tariffs between the two economies. The "wide-ranging agreement is expected to bolster the EU's GDP by around €12 billion ($16.5 billion) per year," according to *World Nuclear News* (more).

Out with the Old

Canada's trade restrictions have been in place since 1970, when Ottawa introduced the non-residential ownership policy (NROP). However, because they came about as a result of Cold War concerns relating to nuclear proliferation, they have become increasingly dated, the *Financial Post* stated.

Of all the provinces and territories involved in the uranium industry in Canada, Saskatchewan holds the largest share. As a result, the province has missed out on some serious investment from foreign companies.

Saskatchewan Welcomes New Trade Regulations

The new trade deal is being viewed as a win for Saskatchewan, which stands to gain billions of dollars in investment in its uranium resources. Currently, trade regulations make it so that foreign ownership in any uranium project is capped at 49 percent. Should the trade regulations change, the province could see up to $2.5 billion in investment over the next 15 years (more). As trade regulations stand, "if you're a European company and you want to invest in a mine in Saskatchewan you need to find a majority partner who's Canadian and for some companies that has been a comfortable proposition, like Areva."

However, Wall expects that if given the choice, foreign companies would prefer not to have a minority ownership in their property. He believes that "the provisions will be gone for these companies ... and so they'll be able to own a mine outright in the province if they choose to develop the resource."

Major Players

With the market opening up in the near future, it seems that many in the industry are waiting to see whether **Rio Tinto** will make a move on Saskatchewan's uranium.

In January 2012, *Rio Tinto* acquired the Roughrider property through its takeover of Canadian junior *Hathor Exploration*. With the takeover, a new entity, *Rio Tinto Canada Uranium*, was created. However, through the bidding process, the company issued a direct challenge to Canada's

Competition Policy Review Panel with a $654-million bid for the uranium project. If Roughrider goes into production, with current regulations, Rio Tinto cannot own more than 49 percent (more).

According to the Canadian Press, "Rio Tinto welcomes CETA and the easing of Canadian restrictions on European Union investment in the uranium mining sector, as we believe policies that promote trade and foreign investment enhance the prosperity of Saskatchewan and other regions of Canada." As far as Canada's biggest uranium player, Cameco, is concerned, changes to the NROP are welcome as long as they include "reciprocal access" with the EU (more).

Europe accounted for 21 percent of the company's uranium sales last year, as per the *Financial Post* (more).

Canada-China Trade

Saskatchewan has made its first shipment of uranium to China since a supplementary protocol to the nearly 20-year-old Canada-China Nuclear Co-operation Agreement was signed by the Harper government last year, Premier Brad Wall announced Wednesday (more).

"Earlier this week, the first shipment of Saskatchewan uranium landed at Shanghai port to be used in the Chinese civilian nuclear industry," Wall told reporters at the Legislative Building Wednesday. "Notwithstanding the fact that there are 28 nuclear reactors being built in China, none of our uranium could fuel them because we didn't have a nuclear cooperation agreement."

The supplementary protocol signed by Foreign Affairs Minister John Baird in Beijing in July 2012 governs and facilitates the export of Canadian uranium to China. The Canada-China Nuclear Co-operation Agreement of 1994 allowed for greater co-operation between the two countries in support of China's civilian nuclear industry, but Baird said the agreement didn't extend to Canadian-sourced uranium. "Thanks to the Prime Minister (Stephen Harper), who took it upon himself to sign (agreements) with China and India, we're now moving uranium to that market," Wall said, referring to Harper's signing of agreements with China and India in 2012 to allow the sale of Canada uranium to those countries (more).

"The protocol is in full accordance with Canada's long-standing nuclear nonproliferation policies and obligations and will ensure that Canadian-supplied uranium is being used in China's nuclear program strictly for peaceful, civilian purposes," the federal government said last year.

Wall, who just returned from a two-week trade mission to Asia, said the deal could mean billions of dollars for the Saskatchewan economy. "Early estimates for what this nuclear co-operation agreement means (are) probably $3 billion in uranium sales over the next decade into the (Chinese) market. This is a big deal. This is the first time for Saskatchewan and it's nice to see the product moving after all of those negotiations and the prime minister's efforts."

Cameco Corp.

Cameco Corp., the Saskatoon-based uranium company and one of the largest uranium producers in the world, also stands to benefit from the changes to the nuclear co-operation agreement with China. "The ability to export Canadian-sourced uranium to China is incredibly important to our company," Tim Gitzel, Cameco's president and CEO, said in July 2012 (more).

Cameco Corp. more than doubled its profit for the third quarter as stronger sales of the nuclear fuel and fixed-price contracts for its product mitigated a slump in uranium prices. Although the price of uranium was 30 per cent lower at $34.75 (U.S.) a pound in the quarter, the company was able to lock in a higher price under previous orders with its customers.

Cameco's realized price per pound of uranium was $50.73 in the quarter, up 12 per cent from $45.26 last year. That combined with the higher sales from its mines in Saskatchewan, the U.S., and Kazakhstan boosted the company's earnings to $211 (Canadian) million or 53 cents share for the three months ending September 30. That was 16.7 per cent higher than the $79 million or 20 cents a share Cameco earned in the third quarter of last year. Analysts had expected the company to earn about 19 cents a share (more).

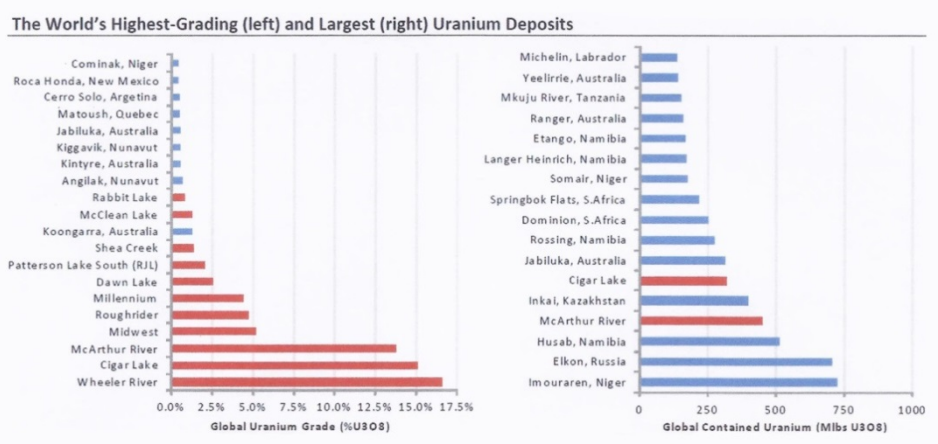
But the company trimmed its production outlook for the year to 23.1 million pounds of uranium from 23.3 million pounds because construction problems forced the miner to delay the start of its key Cigar Lake project in northern Saskatchewan (more).

A joint venture between *Cameco*, France's *Areva SA* and two other partners, Cigar Lake is now expected to start producing uranium in the first quarter of next year but will require a few years more to increase production to earlier levels (more).

Canadian Exploration, Development and Production

The Patterson Lake region, located in Saskatchewan's Athabasca Basin**,** is an emerging area for uranium exploration, development and production (more). Following the release of excellent drill results from joint venture partners *Fission Uranium* (here) and *Alpha Minerals* (here); many companies are staking claims in the area (more).

The JV reported a new uranium strike on land at Patterson Lake South, Saskatchewan. Hole PLS13-118 intersected 20.0 meters total composite mineralization. This discovery hole is considered a substantial achievement and a high priority for follow up. The Paterson Lake area appears to be a world-class deposit (see figure below).



According to Bogner (2013), there is no other solution to the surging global energy demands than nuclear power powered by uranium. The major uranium mining industries know this, which is in contrast to the perception by advisaries that nuclear power plants have no future. However, it is this discrepancy in perception that have created such rock-bottom valuations, enabling the majors to swallow depressed prospective juniors at bargain prices and get from traditional, but somewhat risky uranium producing countries, into more politically stable and richer uranium mining districts, such as the Athabasca Basin in Canada.

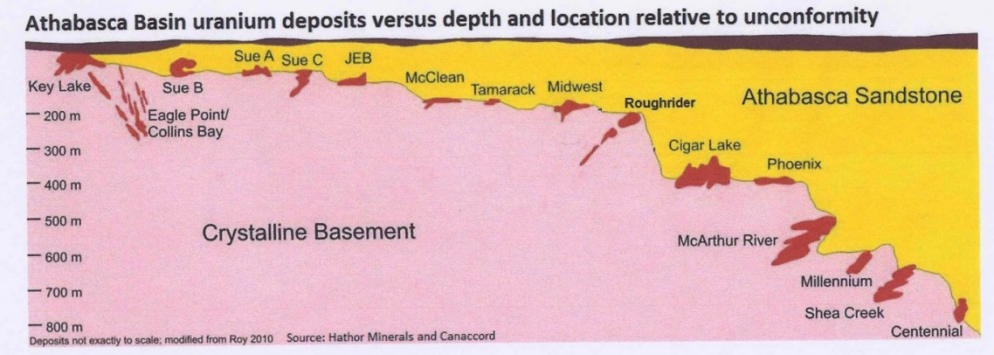
Bogner suggests that the global demand for energy will be so strong over the next decades that no other known energy source or technology will be capable of supplying the expansion - only uranium can solve the upcoming energy problems of planet earth (more).

International Enexco Ltd. recently reported the results of the 2013 diamond drill program on the Bachman Lake joint venture uranium project with *Denison Mines Corp.*, the project's operator. The Bachman Lake project contains several structural zones in graphitic basement rocks associated with anomalous geochemistry; presenting favorable targets for economic, high-grade uranium mineralization.

Asburton reported on a radon survey and boulder assay results from Sienna West Uranium Property, Western Saskatchewan, located roughly 40 kilometers southwest of the *Alpha Minerals Inc.* and *Fission Uranium Corp.* Patterson Lake South discovery. Through an alliance with Alpha-Track Uranium Services, radon detector cups were deployed across the property, and three areas have been identified on the property that merit follow-up surveys. Twelve radioactive boulders were also analyzed for uranium and two reported 12.4 and 184.5 ppm U, with the latter in an area where high radon counts were also detected.

Purepoint Uranium Group Inc. reported that at a recent Technical Committee meeting, *Rio Tinto Exploration Canada Inc*. presented plans for a 2,500 meters drill program this winter at Purepoint's Red Willow Project in Saskatchewan's Athabasca Basin. Purepoint optioned the property to Rio Tinto, allowing them to earn a controlling interest in the Red Willow Project by spending up to

$22.5 million in exploration and development expenses. The various deposits are illustrated in the graphic below:



"We are very pleased to see Rio Tinto's continued commitment to the advancement of the Red Willow project" said Chris Frostad, Purepoint's President and CEO. "This, in addition to the planned program at Hook Lake, will result in 7,500 meters of drilling this winter with the full financial backing and technical support of three of the largest uranium producers in the world."

Australian Activities

Western Australia

Enterprise Uranium has signed an agreement to acquire 18.52% interest in *Energia Minerals* for $820,176 as of October 31, 2013. Under the terms of the agreement, *Enterprise Uranium* will acquire 37,280,714 Energia shares from *Uranium Equities*. *Enterprise Uranium* will pay $500,000 in cash while the balance will be fully paid ordinary shares in ENU at a deemed issue price of four cents while providing Uranium Equities' subsidiary UEQ Investments a 10.49% interest in the company. Commenting on the strategic investment, ENU chairperson Anna Mao said Energia's Carley Bore uranium deposit in the Carnarvon basin has considerable upside potential (more).

"We see Western Australia as being geologically favorable for further uranium discoveries and the eventual development of a number of major uranium mining and processing businesses," Mao added. "We also see a bright future for uranium prices, as solid demand for uranium to fuel nuclear reactors in China and other south-east Asian countries materializes in the coming years."

South Australia

Renaissance Uranium has identified a major chargeability zone indicating extensive sulphide mineralization at its 1050 East prospect within the Olympic Damn iron-copper-gold-uranium belt, South Australia (more). An induced polarization survey outlined the zone immediately east of the

copper-cobalt-silver mineralization intersected in Renaissance's recently completed drilling program at the prospect. The sulphide zone appears to thicken at depth, and remains open to the north. Notably, the trend of sulphide mineralization is coincident with the Angle Dam Fault, 600 meters from the 1050 East prospect area (more).

A diamond core drill program was conducted to test strike potential and has identified a major new copper-cobalt-silver zone within the 1050 East prospect area of its Eastern Eyre project in South Australia. The mineralization is hosted in pervasive alteration zones in mid-Proterozoic metasediments with strong rare earth element and uranium geochemistry, indicating possible association with iron-oxide, copper-gold and uranium (IOCGU) style system typical of deposits located within Olympic Dam belt. Grade and width of mineralized zones also appear to increase at depth with open strike along untested portions of Angle Dam fault structure to the north and south.

The company's follow-up program will include diamond drilling to test for extensions to mineralized zones within 1050 East and its immediate vicinity.

UraniumSA, Adelaide, has lifted grades at its Blackbush deposit at the Samphire uranium project on the Eyre Peninsula after the latest round of drilling. For the first time, *UraniumSA* separated the mineralisation at Blackbush into sediment-hosted and granite-hosted styles in its latest re-estimation (more).

The re-estimation took into account recent drilling results which lifted the bulk average grade of the sediment-hosted mineralization to 320 parts per million U_3O_8. Blackbush's updated inferred resource stands at 41.5 million tonnes mineralization at an average grade of 289 ppm U_3O_8 containing 12,000 tonnes of uranium oxide or 27 million pounds uranium oxide, using a 100 ppm cut-off.

The sediment-hosted style has an estimated inferred resource of 32 million tonnes at an average grade of 322 ppm U_3O_8 containing 23 million pounds of U_3O_8. The company said the increase in the average grade reflected high-grade and thicker intersections achieved in the western zone. The granite-hosted style had an estimated inferred resource of 9.5 million tonnes at an average grade of 175 ppm U_3O_8 containing 4 million pounds U_3O_8. *UraniumSA* reported the bulk average grade of the granite-hosted mineralization might improve as geological knowledge grew and more drilling was completed in the western zone. Prior to UraniumSA's re-estimation separating the granite and sediment styles, the inferred mineral resource for the Blackbush deposit was 28 million pounds U_3O_8 from 45.5 million tonnes of ore grading 280 ppm U_3O_8.

With the results lifting *UraniumSA*'s confidence level in the inferred resource estimate, work has commenced to prepare indicated resource estimation for the western zone of Blackbush. *UraniumSA* will focus on drilling the thickness envelope of the Blackbush deposit western zone in the remainder of the year.

Drilling programs would also target mineralization which demonstrated uranium in granite below the known sediment-hosted uranium in the second half which could create further exploration potential. The exploration objective for sediment-hosted mineralization in the Samphire project is 85-90 million tonnes at 250-330 ppm U_3O_8.

Drilling in the West Zone at Blackbush has intersected mineralization in Eocene sediments over thickness ranging upwards to ~20 meters, frequently with zones of high to very high grade mineralization at the basal Eocene unconformity, and established there is a spatial relationship between the highest grades and mineralized structures in the granite basement. The existing drill pattern is predominantly at 100 meter centers with areas of 50 meter infill and localized closer spacing; this drilling indicates that a separation of ~25 meters will be warranted to define the mineralization and that even closer spacing will be justified to delineate the highest grade material.

Uranium minerals at the site have very high densities (coffinite SG 5.44) and the thicknesses, grades and distribution of mineralization (laterally extensive, flat lying, about 20 meters thick, at ~50 to ~80 meters depth) indicated that it may have a detectable gravity signature which could assist in the optimization of drill patterns.

The gravity test work was carried out in the south end of the West Zone over an area which was known to contain thick intersection of sediment hosted uranium mineralization including a blanket-like accumulation of high-grade material along the unconformity at the basal Eocene unconformity (more).

Northern Territory

Thundelarra Limited has released much awaited assays from drilling at its Allamber copper-base metal project in the Northern Territory that has found more copper and high-grade uranium mineralization (more). This has demonstrated that there is substantial scope to expand its Cliff South uranium prospect as well as areas for further follow-up.

These holes extended the mineralization at Cliff South by 70 meters with the zone remaining open to the north and south while the grade increases at depth. Thunderlarra added the second phase program testing the northern prospects of the Allamber project area has been finished though the first rains of the wet season prevented access to the Swamp Donkey prospect (more).

Overseas Activities of Particular Note

Argentina

Canadian uranium explorer *U_3O_8 Corp* announced that it had discovered an entirely new mineralized area with the highest uranium/vanadium grades found to date in the Laguna Salada district, in Chubut province, Argentina. The La Rosada discovery illustrates the district-scale potential for Laguna Salada style uranium/vanadium mineralisation in near-surface, soft gravels in the semi-desert environment of central Chubut.

The discovery is apparently part of a larger uranium district in which further exploration may lead to more discoveries and significant resource growth potential (more).

Greenland

On October 24, Greenland's parliament formally voted to revoke the territory's 25-year-old ban on mining for radioactive materials such as uranium. The very slim majority – 15 votes in favor, 14 against – and the heated debate that followed demonstrated the extent of the controversy over the issue (more).

The move will not only allow the mining of uranium deposits but also of rare earth minerals used in products such as wind turbines, weapons, computers, smart phones and other high-tech equipment. This group of seventeen elements is in extraordinary demand, with China currently controlling more than 90 percent of the world supply. Until now, the amount of such substances that could be extracted in Greenland had been severely restricted due to the ban, as uranium often occurs with the rare earth mineralization in the deposits.

The vote is likely to further open up the territory to investors from the U.S., Australia, China, the United Kingdom and others who are eager to explore its apparent vast mineral resources. Greenland's government is also keen to exploit the island's natural wealth in order to alleviate some of the serious poverty and social problems that blight the indigenous population. Oil and gas have been the focus of exploitation so far, but Greenland sees just as much potential in an opening-up of mining operations.

Mining has long been all but impossible across most of the territory, which is covered in a thick sheet of ice except for a few coastal strips, but melting ice and new techniques have created new possibilities for exploiting the region's mineral resources. With Greenland containing some of the world's largest uranium reserves and the available world supply already falling short of projected demand, uranium could be a huge cash generator for Greenland's struggling economy.

Mongolia

French nuclear energy giant *Areva* signed a deal with Mongolia's state-owned *Mon-Atom* to develop two uranium mines in the Gobi desert, officials said (more). Areva said in a statement that the agreement would create a company that would be 66 percent owned by Areva and 34 owned by *Mon-Atom*, and that Japan's *Mitsubishi Corporation* would take an equity interest. Further details of the deal, which was signed during a visit to Mongolia by French Foreign Minister Laurent Fabius, were not immediately announced. Fabius' Mongolian counterpart, Luvsanvandan Bold, said the deal represented an important step for the resource-rich but still impoverished nation.

Areva, which has had a presence in Mongolia for more than 15 years, said that exploration work had discovered two uranium deposits with estimated reserves of 60,000 tonnes. Mongolian protesters had warned before the signing that a deal could lead to the contamination of water resources in the area.

Wedged between Russia and China, Mongolia has recently been seeking to broaden the base of its political and economic allies, notably exploring relationships with France, Japan and Germany.

Africa

Algeria

In Algeria, uranium exploration occurred in the 1970s, resulting in the discovery of the Tahaggart deposit, as well as other mineralization. The government reports Reasonably Assured Resources of 26,000 tonnes U* in the under $80/kg category. In September 2009, the National Mining Patrimony Agency put uranium exploration leases in the southern Tamanrasset province out for tender (more). *Note: Conversion of U to U_3O_8 multiply by 1.1792

South Africa

South Africa offers sufficient uranium reserves to support a nuclear program. The government there insists that a decision on the extent of implementation of a nuclear power program will be made in early 2014.

The SA Department of Energy (DoE) will undertake study tours to several key nuclear-energy jurisdictions, including China, France, Korea and the U.S., to determine South Africa's approach, should nuclear be confirmed as part of the country's future energy mix (more).

The decision to proceed with the proposed building of nuclear power plants, which aims to add 9,600 MW of nuclear electricity generation capacity to the national grid, was indicated by the

Integrated Resources Plan 2010 (IRP 2010), which outlines the country's energy mix for the next 30 years. The IRP 2010 indicates the need to diversify the energy mix, a specific emphasis on broadening electricity supply technologies to include natural gas, biomass and renewable and nuclear energy, in response to the country's future electricity needs and its commitment to reducing carbon dioxide emissions.

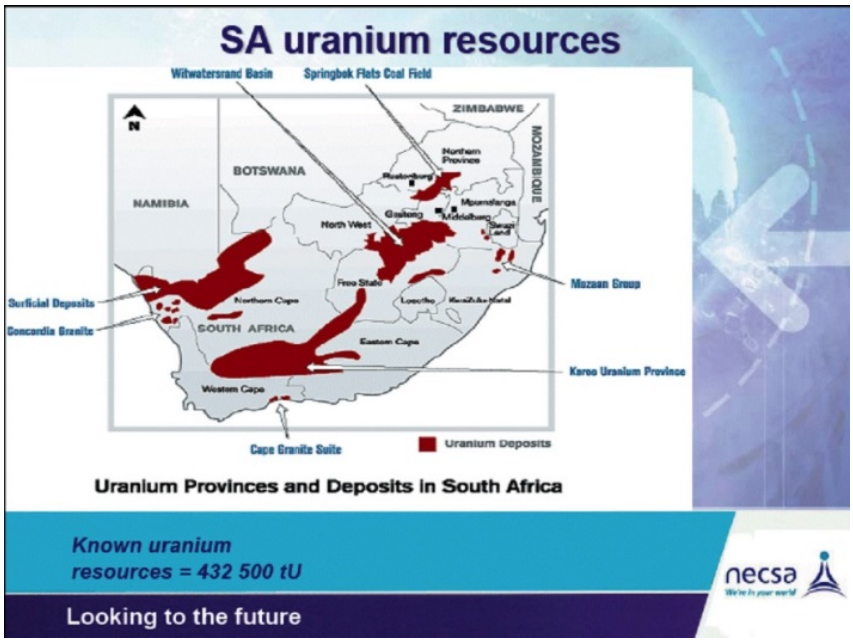
In light of this, independent mining and minerals management adviser Venmyn Deloitte exploration manager Andrew de Klerk says, should the proposed 9,600 MW of nuclear power be included in the future energy mix, there are sufficient uranium resources in Africa – in Southern Africa in particular – to justify the development of a nuclear program without having to import uranium from other parts of the world, such as Canada or Australia. Further, the knowledge base of Southern Africa's geology, in terms of the distribution of uranium deposits on the continent, is apparently well understood and explored.

South African Uranium Resources

Based on this long-standing knowledge and historical and current exploration results, De Klerk suggests that the bulk of the uranium required to support a nuclear build in South Africa would be sourced from the gold-rich Witwatersrand basin, which stretches from Evander, in Mpumalanga, westward through Gauteng and into the southern and western Free State. The Witwatersrand basin holds significant deposits of uranium, which is largely mined as a by-product to the primary target of gold.

De Klerk says this world-famous geological formation is bound to be the primary source of uranium, as established mining infrastructure is in place to exploit the uranium, in addition to what has already been stockpiled on surface or exists in historical tailings storage facilities. Further, historical and recent exploration and trial mining results indicate significant uranium resources within the Karoo sediments of the Western Cape, in what has been delineated as the Karoo Uranium province (see photo below), which extends into the neighboring Eastern Cape and Free State provinces (more).

In addition, uranium is present in the 'Coal Zone' of the Ecca group, in the Springbok Flats coal field, north of Pretoria. Other documented uranium deposits of South Africa include deposits within offshore marine phosphate deposits, within the Mozaan Group of KwaZulu-Natal, which are similar to the deposits within the Witwatersrand, and primary deposits within the Cape Granite and Concordia Granite Suites of the Western and Northern Cape (more).



Other African Uranium Resources

Uranium exploration is also being actively carried out in Botswana, Central African Republic, Chad, Democratic Republic of Congo, Gabon, Guinea, Malawi, Mali, Mauritania, Morocco, Namibia, Niger, Tanzania, Zambia, and Zimbabwe, and Chad, in West and Central Africa. The following was taken from synopses by the World Nuclear Association (more).

Botswana

Africa's uranium deposits also extend east into Botswana, with significant exploration for uranium being undertaken in paleochannels, gypcretes and calcretes. Australian mining company, **A-Cap Resources**, will develop Botswana's first uranium mine by 2017, according to the company's annual report (more[1])(more[2]). The plan is to exploit one of the world's largest untapped uranium deposits – some 350 million pounds – in the north east of the country at Letlhakane. Production is targeted at 3 million pounds per year and the mine life is expected to be over 20 years. Botswana is consistently ranked first among African mining destinations and near the top for mining-friendly destinations globally. **A-Cap** holds over 3,600km² of exploration licenses in Botswana (more).

Central African Republic

Having taken over **UraMin Inc**, **Areva** was proposing to develop the $200 million Bakouma project, originally discovered by **Cogema (Areva)** and more recently taken forward by **UraMin Inc** of Toronto. It aims to start open pit mining at 1200 tonnesU/yr, with ore grading

1.27%U. Following a test phase from 2010, the project was to ramp up to full production in 2014-15, but this is now delayed at least two years after expenditure of EUR 107 million, due to low uranium prices and the need for further research on the metallurgy. Resources have been reported as 32,000 tU by **Areva Resources Centrafrique**, which holds a 90% interest over ten separate deposits. The government holds a 10% free carried share, and was disputing some aspects of the **Areva** takeover of **UraMin**'s rights until an agreement was signed in mid-2008 (more).

Chad

The following companies are performing uranium exploration in Chad: **Uramin Inc**., (more); **Brinkley Mining PLC**; **Signet Mining Services Ltd** (more); Blue Marine Global Ltd.; and Chad Mining Services (more).

Congo, Democratic Republic

The Belgian Congo, as it was once called, provided much of the uranium for the U.S. Manhattan Project in the early 1940s, particularly from the Shinkolobwe mine, 25 km west of Likasi in Katanga. There was some uranium mining subsequently by **Union Miniere**, to independence in 1960, when the shafts were sealed and guarded. About 25,000 tU was produced in the two decades until then. The deposit has been unofficially mined since 1997 for cobalt. A UN report in 2004 described the political situation as anarchistic. This has prompted some concern by the International Atomic Energy Agency of the possibility that some uranium might be finding its way to countries with illicit weapons programs. In the south-eastern region of Katanga the geology is contiguous with the Zambian copper belt.

In 2009, **Areva** signed a uranium exploration agreement for Katanga with the government, focused on Shinkolobwe, but has since said that it will not embark on any plans for mining while the country remains politically unstable. The country ratified the Nuclear Non Proliferation Treaty in 1970 (more).

Gabon

No current uranium mining occurs in Gabon, but exploration continues. Historically, uranium mining in Gabon has been closely linked with Niger due to the role of the French Atomic Energy Commission and **Cogema** (now **Areva NC**).
The Mounana uranium deposits in southeastern Gabon were discovered in 1956 by French Atomic Energy Commission (CEA) geologists and were mined from 1960 to 1999, producing nearly 28,000 tonnes of uranium. The best known of these deposits is Oklo, discovered in 1968, which

produced over 14,000 tU. (Oklo is famous for its fossil nuclear reactors, which operated naturally in the wet-dry sandstone orebody about two billion years ago.)

The **Franceville Uranium Mines Company** (COMUF) was formed in 1958 and undertook the mining and processing. It was 68.42% owned by **Cogema** and 25.8% by the national government. The ore was mined largely in open cut operation but also underground, from five discrete orebodies with average ore grade of 0.37%. Milling was at Mounana. Production fluctuated from 400 to 1250 tonnesU/yr, with a total of 12,147 tonnes U coming from open pit mining and 15,725 tonnes U from underground mining. Operations were shut down in mid 1999 due to a lack of economically recoverable reserves - Reasonably Assured Resources (RAR) of 4830 tonnes U @ under US$ 130/kg is quoted. The facilities were dismantled and the site is in the final phase of rehabilitation (more).

Extraction of the ore began at the Mounana open pit mine (1960-75), followed by the mine at Oklo (1970-85). Ore was also extracted from underground mines, first at Mounana, then at Oklo (1977-97), and at Boyindzi (1980-91). During the last two years, the open pit at Mikouloungou, 60 km away, was mined (1997-99).

Up to 1975, some two million tonnes of tailings were released into the local Ngamaboungou creek and Mitembe-Likedi River system, along with mill effluent. Then four million tonnes were emplaced in the Mounana pit. In 1990, a tailings dam was built across the Ngamaboungou creek for the balance.

In 1985, **COMUF** started works to stabilize the course of the Ngamaboungou creek with rock, and to cover the tailings deposits formed in the valley along the creek with a layer of 30 - 50 cm compacted laterite. The tailings deposit in the former Mounana open pit was covered with a cover of broken rock and laterite soil. Contaminated areas at the processing site were covered with a layer of 0.7 meters minimum of lateritic soil. The rehabilitation work was completed in July 2004, at a total cost of EUR 10.7 million including EUR 7 million from EU funds.

Gabon is party to the Nuclear Non-Proliferation Treaty and signed a safeguards agreement in 1979, but does not have a comprehensive safeguards treaty in force (more).

Guinea

Several companies are exploring for uranium in Guinea. In August 2007, the government noted that **Murchison United NL**, now **Forte Energy NL**, had encountered some encouraging mineralization (or even "commercially viable deposits") at its Firawa prospect, 600 km east of the

capital, Conakry. **Forte** has announced 4470 tonnes U JORC-compliant inferred resource at Firawa, with 1-2% rare earth elements (REE) present which are as yet unquantified but are prospective by-products. **Toro Energy** and **Contico** also hold exploration licenses (more).

Malawi

Paladin Energy, based in Perth, Australia, has developed the **Kayelekera** uranium mine in northern Malawi, west of Karonga. As of April 2011, this had reserves of 11,265 tU at 0.04% cut-off, within 15,000 tU measured and indicated resources in average 0.08% ore (JORC and NI 43-101 compliant). Inferred resources add 2,900 tonnes U. The orebody remains open to the west and exploration is proceeding here and on nearby leases, including Mpata to the east and Juma to the south.

The deposit was discovered by UK's CEGB and a feasibility study was subsequently undertaken in the 1980s. Paladin acquired the deposit in 1997, accepted a Bankable Feasibility Study early in 2007, and following environmental approval undertook a US$ 220 million mine development. The mine was opened and commenced production in April 2009. **Paladin (Africa) Ltd** holds Paladin's 85% interest following the Development Agreement with the Government of Malawi, and the government holds 15%.

Kayelekera production commenced in mid 2009, with 670 tU being produced in 2010 from open pit. In 2011, production was 842 tU and in 2012 it reached 1,103 tonnes U. In first six months of 2013: 598 tonnes U. It employs a conventional acid leach treatment process, and is expected to ramp up to 1,460 tonnesU/yr. The Kayelekera uranium mine, in adjacent northern Malawi, owned by uranium producer **Paladin Energy**, is one of the major producers of uranium in the region exploiting a similar style uranium deposit as being explored for, and developed, in southern Tanzania.

The Livingstonia uranium deposit is in similar geology some 100 km southeast of Kayelekera, but as yet unquantified (more).

Mali

The Falea copper-silver deposit in southwestern Mali is being explored by **Rockgate Capital Corp of Canada**, building on some earlier work by **Cogema** in the 1970s. Uranium is envisaged as by-product. Measured and indicated resources (NI 43-101 compliant) of 11,400 tonnes U at average 0.073%U grade are reported (December, 2012), and inferred resources of 6,050 tonnes U at 0.042%U. In 2012, a further uranium mineralized north zone was identified. Mineralization is in sandstones, and the project is 20 km north of the Guinean border (more).

Mauritania

Forte Energy NL, based in Australia in April 2012, released JORC-compliant inferred resource figures of 9000 tU at 0.020%U for its A238 uranium prospect in granites near Bir Moghrein in the north of the country near Western Sahara. There is a main zone of mineralization over a strike length of 1.75 km with mineralization extending down to over 250m from surface with widths of over 60 meters within 50 meters of the surface. **Forte** also has 800 tonnes U in the **Bir En Nar** deposit nearby. **Areva** holds 11.3% equity in **Forte**, and will join in any major development.

Australia's Aura Energy in July 2011 announced a JORC-compliant resource of 19,000 tonnes U at 0.028%U in a shallow calcrete deposit on the Reguibat Craton in the north of the country, close to Algeria and Western Sahara (more).

Morocco

The government's Office National des Hydrocarbures et des Mines (ONHYM) is encouraging exploration for uranium to build upon that conducted by French and Russian geologists prior to 1982. Three areas are under investigation: Haute Moulouya, Wafagga and Sirwa. The first two have palaeochannel deposits. **Toro Energy** holds tenements in Haute Moulouya area. In October 2007, **Areva** signed an agreement with Morocco's Office Cherifien des Phosphates (OCP) to investigate recovery of uranium from phosphoric acid. The amount of uranium in Morocco's phosphates is reported to be very large, and the feasibility of recovering uranium as a by-product of mining them is under active consideration. In 2007, 27 million tonnes were mined for fertilizer. Morocco also controls Western Sahara to its south (more).

Namibia

Namibia also hosts well-documented uranium deposits, such as the enriched surficial calcrete uranium deposits. Such deposits are exploited by **Paladin Energy** at its Langer Heinrich uranium mine, east of Walvis Bay, and at the neighboring global energy group **Areva Resources** Namibia's Trekkopje uranium mine – a mine which stands to become one of the continent's largest uranium producers.

Namibia also hosts primary uranium deposits in granites, which is mined at diversified mining giant **Rio Tinto**'s Rössing uranium mine. This is the oldest and one of the largest uranium mines in the world, having initiated operations in 1976 (more).

Nigeria

In March 2009, Russia signed a cooperation agreement with Nigeria, including provision for uranium exploration and mining in the country. A further broad agreement in June 2009 envisaged the construction of a Russian power reactor and a new research reactor (more).

Niger

Terrorist attacks on the Areva mining operations at Arlit and in the nearby town of Agadez in Niger (more) have halted the company's planned activities on its nearby exploration properties. **Paladin Energy Ltd** is currently in discussion with the relevant Niger authorities and has applied for a Force Majeure consideration so it can halt expenditure until the security situation improves.

Gazprombank NGS , a unit of Gazprom OAO (more), won a license to explore for uranium in the region of Agadez in northern Niger, the government said in a statement. The Moscow-based company will invest $5 million in the project, according to today's statement (more).

In 2009, **Korea Resources Corporation** (KORES) announced that it had signed a memorandum of understanding with African country Niger to import an annual 400 tons of uranium used for nuclear power. The promised annual 400 tons comprises 10 percent of the uranium used in Korea for a year. The state-run company also plans to buy a five-percent stake in a uranium mine being developed by Niger. (more, Chosunilbo Mar 20, 2009)

The Earthstone Group, (more) a diversified multinational group headed by non-resident Indian Pankaj Shah, has, through its wholly-owned subsidiary **Earthstone Uranium FZE**, entered into an agreement with the Government of the Republic of Niger, whereby the Republic of Niger will grant **Earthstone Uranium** four exploration permits for uranium and associated elements. The four permits totalling about 2,000 sq. km. are part of the Tim Mersoi sedimentary basin. These permits in Niger are in regions now producing uranium, including the Akouta underground mine and Arlit open pit mine operated by Areva. (The Hindu Dec. 3, 2008, (more).

Niger government has concluded a deal with China to upgrade the country's power supplies. Niger obtains most of its power from Nigeria but had several blackouts since January due to systems collapse in Nigeria. In the agreement aimed at improving Niger's power supplies, China - which is currently the main investor in uranium mining in the country - will transfer ownership of electrical power units to Niger. Niger's head of power plant in capital Niamey, Mr Hamidu Mamudu, said the new equipment would help increase production of electric power by about 30% for the Niamey region saying equipment will also increase power output between 50 and 60 megawatts. (Afrol News, July 7, 2008, (more)).

Niger Energy and Mines Minister, Mamadou Abdulahi, said that in return the country will award 100 mining exploration permits to China over the next two years. State-controlled French utility **Areva** has enjoyed a monopoly on production of uranium in Niger for some 40 years. In recent years, the government has issued a number of new exploration licenses in an effort to diversify the uranium sector. (Resource Investor, January 10, 2008, (more).

Taurian Resources Pvt Ltd. has recently won a contract which gives it exclusive rights over 3,000 sq. km. of the Sahara Desert known to be rich in deposits of uranium. According to the estimates of the Managing Director of the company, Sachin Bajla, the area in the Arlit region is likely to hold at least 30,000 tonnes of uranium. This is the first time any Indian has won a contract for uranium exploration and mining anywhere in the world (more).

Niger is not a member of the Nuclear Suppliers Group, the 45-member nation that controls all nuclear-related commerce, and hence it should be easy for India to access the uranium once the mines become operational - this will take several years. (The Hindu Aug. 19, 2007, (more).

A Security Alert

A Chinese employee of a mining company was captured on July 6, 2007, by Tuaregs of the rebel Movement of Niger People for Justice (MNJ) in the Ingall region 100 kilometres south of Agadez, the movement said. According to the Niger government, the Chinese national worked with a team prospecting for uranium. (The News July 7, 2007). The Chinese company has suspended its activities in the country. The kidnapped employee was released on July 10, 2007. (Reuters July 10, 2007, (more).

Niger communication minister and government spokesman Mohamed Ben Omar has said his country plans to raise its annual uranium production from 3,500 to 10,500 tonnes a year in the next few years. Speaking at a recent news conference, Omar said French group **Areva** will remain Niger's strategic partner in uranium exploitation. Reacting to statements by non-governmental organizations (NGOs) on the health and environmental consequences of uranium exploitation in northern Niger, he said Areva plans to invest about 540 billion francs CFA [US$ 1.1 billion] in the well-being of people living in the affected area. (*Africast* May 3, 2007, (more).

Tanzania

Several companies are exploring for uranium in Tanzania. **ARMZ's Uranium One, Inc.** is undertaking a definitive feasibility study for its Mkuju River project in the Namtumbo district of southern Tanzania, incorporating the Nyota prospect, 470 km southwest of Dar es Salaam. Government environmental and other approvals are well advanced and **Mantra Tanzania Ltd** was granted a Special Mining License for the project in April, 2013. The government has allocated 345 km^2 of land inside the 50,000 km^2 world heritage Selous Game Reserve to the project - 0.7% of its

area, and with hypothecation of some $5 million per year of mine taxes (ten times the Reserve's present budget) to its management. The UNESCO World Heritage Committee in July 2012 accepted the Tanazanian government request to excise the area required for mining (more).

Uranium One expected to start mining in 2013, eventually producing 1,400 tonnesU/yr. JORC-compliant measured and indicated resources of 36,000 tonnesU and inferred resources of 10,000 tonnes U with average grade 0.026%U are quoted at 100 ppm cut-off (November, 2011). These are extensive, in sandstone at shallow depths, and will be mined in multiple pits feeding a single mill with conventional acid leach and resin in pulp recovery. Capital costs are estimated at US$ 430 million for the treatment plant and infrastructure, mining will be contracted. A preliminary feasibility study on heap leaching lower grade ore as Phase 2 of the project is under way, and results appear to be promising.

The project was commenced by Australia's **Mantra Resources Ltd**, which was taken over by **ARMZ** in mid-2011 for $1.16 billion, allowing *Uranium One* (then 51% owned by ARMZ) to take over development of the Mkuju River project and other exploration activities. *Uranium One* has an option to acquire Mantra from ARMZ. However, the Tanzanian government is claiming $196 million in capital gains tax from ARMZ, plus $9.8 million in stamp duty.

Mkuju River Project is on track and currently preparing for construction to start, as announced at the Tanzania 2013 Indaba Conference. Presenting a paper on 'Tanzania Mining Energy Transition to Uranium Mining,' Mantra Tanzania's Managing Director, Asa Mwaipopo said, they were in final discussions with the government on Mining Development Agreement. He said they had received UNESCO's approval to a minor boundary change of the World Heritage area – granted in July 2012, Environmental Impact Assessment Certificate – granted in October 2012 and Special Mining License – issued in April 2013. Consent to Operate in a Game Reserve was still pending until the Mining Development Agreement is reached, he said (more).

He told the Indaba, a conference that attracted over 500 people from around the world, that it would bring in foreign direct investment in excess of $1 billion over the life of the mine, Project royalties, $195 million over the life of the mine, project corporate taxes – US$363 million over the life of the mine and substantial new employment, 1,600 jobs created during construction and over 700 permanent jobs. He said it had already significantly enhanced environmental protection and wildlife conservation benefits for the Selous through Protection cost and CSR (Anti-poaching Initiative).

The theme for this year's Indaba Conference in Dar es Salaam, was "…increasing local content and indigenous participation in the mining, energy/oil and gas, and infrastructure sectors and delivering the critical insights and business networks to navigate a fast changing mining and energy investment landscape." He said that a Mining Development Agreement and the Consent to Operate in a game reserve are the key outstanding government permits, adding that full permitting

will be followed by a detailed design. He said construction to commence with early works (access road, construction camp) by the next dry season is subject to the permits. He said it would need two years of construction work before commencing production (more).

Mantra Uranium had two project areas in Tanzania, i.e., the Mkuju River Project in Southern Tanzania and the Bahi North Project in Central Tanzania. “It will take a two-year period for completing construction work before we start to produce uranium oxide. Tanzania will become number 3 in Africa in uranium production after Niger and Namibia,” Mwaipopo said.

The uranium update comes days after the government announced that 175.8 million tonnes of uranium reserves have been confirmed so far at Mkuju River, whose extraction will enable the Treasury to collect 363 million U.S. dollars in corporate taxes and 50 million dollars in other taxes. Other topics discussed at the Indaba Conference included ‘The legislative and regulatory framework in the mining and energy sector, contracting with state entities and stabilization clauses/bilateral investment treaties (more).

In the south, close to *Uranium One*'s Mkuju River project and with similar geology, Australia's **Uranex NL** is developing its Mkuju Uranium project, with Likuyu North and other deposits which have significant mineralization. A mineral resource estimate for Likuyu North in 2012 suggested about 2,350 tonnes U.

In central Tanzania, some 80 km west of Dodoma and adjacent to its Bahi deposit, **Uranex** in 2010 reported inferred resources of 12,000 tonnes U in a shallow deposit at Manyoni, which it hoped to mine in 2013. The Itigi prospect is 50 km west of Manyoni. Mining approval for Bahi was given by the government in 2009. In the south-east, **EastAfrica Resources Ltd**, based in Perth, is investigating its Madaba-Mkuju sandstone roll-front deposits, originally discovered in 1978. In December 2011, **Korea Resources Corporation** (KORES) agreed to invest $3.5 million for a 50% stake in the Mkuju South project.

U.S.-based **Uranium Resources Inc** (URI) in May 2013 announced inferred resources of 770 tU for its Mtonya project, most of which is potentially an ISL operation in similar geology to *Uranium One*’s Nyota deposit.

The 2010 government announcement of a uranium mining law assists the diversification of its mining sector. It has also expressed an intention to investigate the use of nuclear power for electrical generation in the country (more).

Zambia

Denison Mines of Canada is planning to develop its US$ 118 million Mutanga uranium project in southern Zambia, when uranium prices improve beyond $65/lb. Denison announced a NI 43-101-compliant resource in March 2009, based on two shallow orebodies: Mutanga and Dibwe. Measured resources for Mutanga quoted in mid-2012 are 770 tonnes U at 0.04%U, indicated resources 2,254 tonnes U and inferred resources 16,100 tonnes U. In March 2012 Denison announced 10,870 tonnes U inferred resource for Dibwe East, between the other two (more).

Following successful license renewal, a feasibility study was undertaken for an open-pit mine with acid-heap leaching. The project is licensed with 25-year mining license, environmental approval and radioactive materials license. The Mutanga pit would be 750x550 m and the Dibwe pit 10 km southwest would be 1500x300 meters in size. The project, formerly known as Kariba, was developed by **Omega Corp**. prior to its acquisition by **Denison**.

Equinox Minerals, based in Perth, Australia, is operating the US$ 762 million Lumwana project in NW Zambia. This is primarily a large copper mine, with two open pits 7 km apart. In 2010 it produced 146,690 tonnes of copper. Following a bankable feasibility study on uranium recovery the company announced 3,800 tonnes U indicated resources at 0.079%U and 2,570 tonnes U in inferred resources. The uranium is in discrete uranium-enriched zones that are being mined separately from the copper ore and stockpiled.

An environmental impact assessment of the uranium project was approved in December, 2008 and treatment of uranium ore to produce 700 tonnesU/yr was planned from 2010. However, investment in the $230 million uranium mill was deferred due to low prices and difficulty in financing this part of the project. The Malundwe open pit is the first of two uranium sources within the overall project, where the mineral is in discrete veins in the broader copper mineralization (more).

In January 2011, the company said that it had 4.6 million tonnes of uranium ore stockpiled containing 0.09% uranium and 0.8% copper. "This uranium-copper stockpile may be treated at a later date, if and when the Company builds a uranium plant." Meanwhile it is being classified and expensed as "waste" to the copper project. In mid-2011, Equinox was taken over by **Barrick Gold Corp**. for C$ 7.3 billion, in the face of a rival bid from China's **Minmetals**.

The Chirundu project near the Zimbabwe border is focused on exploring the Njame and Gwabe deposits and reports 4300 tonnes U as measured, indicated and inferred resources. **African Energy Resources** now holds 100%. A mining license was granted for the project in October 2009, with a view to a 500 tonnesU/yr acid heap leach operation. It includes the Siamboka prospect. A feasibility study was commenced but then deferred due to low prices. The company is also exploring the Chisebuka deposit 250 km along strike southwest.

Karoo Exploration Corp. has entered into a letter of intent with **African Energy Resources** to acquire the Chirundu Project, and a slew of uranium properties, in Zambia (more). According to the company's press release:

"The Chirundu Project will add to Karoo's existing portfolio of Uranium projects in Africa. The properties are located in the south and northeast of Zambia, and are comprised of the Chirundu, Kariba Valley, and North Luangwa Valley projects. The uranium mineralization at Chirundu and Kariba is hosted by Karoo Supergroup sediments, whereas the North Luangwa Valley mineralization is hosted in feldspathic gneisses of the Karoo basement."

Karoo can acquire the project, and accompanying properties, in consideration for the cash payment of US$2,000,000, and the issuance of an equity package consisting of shares and share purchase warrants with a value of US$500,000.

The acquisition remains subject to certain conditions, including Karoo obtaining financing on acceptable terms, completion of due diligence satisfactory to both Karoo and **African Energy**, and approval of the TSX Venture Exchange. All securities issued in connection with the acquisition will be subject to a four-month hold period. The acquisition cannot be completed until these conditions are satisfied, and there can be no assurance that the acquisition will be completed as proposed or at all (more).

Zambia has upgraded its mining legislation to take in uranium, following detailed consultation with the IAEA. It started issuing uranium mining licenses late in 2008. It is signatory to the NPT and has been a member of the IAEA since 1969 (more).

Zimbabwe

The 2009 Red Book notes 1,400 tonnes U as reasonably assured resources in the $130-260/kg bracket, and also speculative resources of 25,000 tonnes U. Other reports mention a deposit at Kanyemba, north of Harare, in which Iran has expressed some interest (more).

Uranium Resources Elsewhere in the World

Turkey

Anatolia Energy has contracted a substantial work program including 6,000 meters of drilling at its Temrezli in-situ recovery uranium project in Turkey (more). Temrezli is one of Turkey's largest and highest grade uranium deposits, with a JORC resource estimate of 17.41 million pounds of

contained uranium at a grade of 1,170 parts per million, and lies close to established infrastructure (more).

The scope of each engagement will ensure a detailed pre-feasibility study, expected in late 2014, whilst drilling at Temrezli and nearby satellite sites should expand and re-classify the current JORC mineral resource.

Anatolia has signed agreements with various firms to conduct the program of work, funded by a recently completed raising $6.2 million in capital. Works will also include an environmental impact assessment and additional hydrological and metallurgical studies (more).

India

With the requirement of uranium expected to grow, India is expanding its search for countries, mostly in Central Asia and Africa, from where it could procure the fuel for the nuclear plants whose number is going to increase in the coming years. As part of this endeavor, a delegation of Department of Atomic Energy (DAE) travelled to Uzbekistan to explore the possibility of procuring uranium, sources told PTI (more).

These sources indicated that a contract for procurement of uranium could be ready in the near future. India is looking at importing about 2,000 tonnes of uranium by 2014 from Uzbekistan, which has 1,85,800 tonnes of proven uranium deposits. The visit by DAE team took place against the backdrop of talks between External Affairs Minister Salman Khurshid and his Uzbek counterpart Abdulaziz Kamilov last month in Tashkent on the sidelines of Shanghai Cooperation Organization (SCO) Conference.

During the talks, the issue of uranium import to India was discussed. India already has a contract for uranium import from other Central Asian nations, Kazakhstan and Mongolia. Apart from these countries, Kyrgyzstan also has rich uranium deposits. "It is not that we are focusing on Central Asia only, but the region happens to have proven reserves of uranium. We will try to procure uranium from wherever possible," said a senior DAE official. "We are also looking at Niger and Namibia to get our supply of uranium," the official added. Both these countries have rich deposits of uranium. In 2009, India also signed a civil nuclear cooperation with Namibia.

India moved a step closer to sourcing uranium from Australia, the world’s biggest exporter of the radioactive mineral, with the Foreign Ministers of both countries agreeing to hold the third round of talks on a bilateral civil nuclear agreement towards the end of this month.

External Affairs Minister Salman Khurshid and his Australian counterpart Julie Bishop reaffirmed the commitment of both countries to finalize a Civil Nuclear Cooperation Agreement to enable the

sale of Australian uranium to India, and announced that the third round of negotiations would be held here in the last week of November. They met in Perth during a multilateral conference (more).

Nuclear Outreach

James Conca, Ph.D., a member of the Advisory Group of this UCOM, has been contributing popular articles to Forbes.com, many on nuclear subjects. Some of these articles are listed below:

1. Beyond Earth's Atmosphere: Energy Needs for Space Colonization (here).
2. Like We've Been Saying -- Radiation Is Not A Big Deal (here).
3. How Deadly is Your Kilowatt? We Rank the Killer Energy Sources (here).

Also, the I2M Associates Web Portal provides up-to-date articles and reviews of current and historical uranium and related activities in the U.S. and around the world (more).

II. Uranium-Related University Research Activity

By Steven S. Sibray, C.P.G., (Vice-Chair: University), University of Nebraska, Lincoln, NE

Engineering researchers at the University of Michigan are evaluating how radiation damages the different materials used in the construction of nuclear power plants (more). There are roughly 100 nuclear power plants in the U.S., and most of them are approaching retirement (more). Researchers want to establish the reactors' lifetime and how they hold up in such harsh environments over time. Dr. Gary Was is with the nuclear engineering and radiological science department at the University of Michigan. He hopes the research will show how different materials, like steel, will react inside a nuclear reactor.

"We are very interested in tracking how radiation is affecting their performance. And we want to be able to predict what it's going to look like in another 10 years or 20 years or 30 years – how long can these plants go?" Was says it's increasingly difficult to use test reactors for this kind of research because it takes too long and it's too expensive.

"Once we're able to show that, yes this really works it really works really well; we should be able to experience a quantum leap in the development of materials for these harsh environments," Was said. If it works, older nuclear plants may be able to last longer or new plants with harsher environments could be developed (more).

The U.S. Department of Energy is paying for the three-year $5 million study (more). It's led by University of Michigan but includes six other universities; plus national laboratories and international partners in the United Kingdom and France.

Research Awards and Grants

The Society of Economic Geologists Foundation (SEGF) and the SEG Canada Foundation (SEGCF) recently announced the Student Research Grant awards for 2013. Of the 66 grants awarded, two were awarded for uranium deposit research and six were awarded for research on deposits of rare earth elements (REEs). One award was for research on U-REE mineralization associated with mid-crustal Iron Oxide Copper Gold (IOCG) deposits. The nine grants totaled US$14,750 and CAN$11,300.

Also see the M. McMurray Memorial Grant, page 2 of this report.

Hugh E. McKinstry Fund (2013 Recipients)

Granted to students whose projects involve studies of mines or ore districts; topical studies toward improved understanding of ore genesis; and experimental research in field applications:

Name	Award Amount	University	Degree	Project Area
Sandra Amores Casals	US$3,750	University of Barcelona (Spain)	Ph.D.	Rare elements of Monte Verde and Coola carbonatites from Angola. **[REE]**
Sam Broom-Fendley	US$3,000	Camborne School of Mines, University of Exeter (UK)	Ph.D.	Targeting heavy rare earth elements in carbonatite complexes. **[REE]**
Marc Campeny Crego	US$2,500	University of Barcelona (Spain)	Ph.D.	Dynamics of emplacement of the Catanda volcanic carbonatites (NW Angola): Metallogenic implications. **[REE]**
Matthew McGloin	US$3,500	Monash University (Australia)	Ph.D.	The genesis of U-REE mid-crustal systems and their links to IOCG deposits. **[U+REE]**
Alicia Metzger	US$2,200	Missouri State University (USA)	M.Sc.	Gravity and magnetotelluric investigation of the FeO-REE deposits at Pea Ridge, Washington County, Missouri. **[REE]**

Canada Foundation (2013 Recipients)

Supports study of Canadian mineral deposits or mineralized regions, research at Canadian universities, or Canadian students studying at foreign universities:

Alexey Li	CAN$3,000	Queen's University (Canada)	Ph.D.	Uranium mineralization in peralkaline intrusive complexes. **[U]**
Valeria Li	CAN$2,500	Queen's University (Canada)	Ph.D.	The uranium deposits of the Macusani district, Puno, southeastern Peru: a new ore genetic model. **[U]**
Krisztina Pandur	CAN$3,000	University of Saskatchewan (Canada)	Ph.D.	Fluids responsible for high- and low-temperature REE mineralization, northern Saskatchewan. [**REE]**
Alexander Timofeev	CAN$2,800	McGill (Canada)	M.Sc.	Niobium and Tantalum Mineralization in the Nechalacho REE Deposit, NWT, Canada. **[REE]**

Research Activities at Australian Universities and Government Agencies

Australia has the world's largest Reasonably Assured Resources (RAR) of uranium and currently is the world's third largest producer of uranium after Kazakhstan and Canada. There are three operating uranium mines, at Olympic Dam and Beverley in South Australia and Ranger in the Northern Territory, plus three additional operations are scheduled to begin production in the near future. Australia's uranium production is forecast to more than double by 2030. Australia is a dominant supplier to the world and has been so for the past 30 years (more). The country has a vigorous research program underway at the federal, province, and university levels.

III. Uranium-Related Government Research Activity

By Robert W. Gregory, P.G., (Vice-Chair: Government), Wyoming State Geological Survey, Laramie, WY

Uranium related research at government agencies in 2012 was mostly limited to the USGS and the Wyoming State Geological Survey (WSGS) in cooperation with the University of Wyoming Department of Geology and Geophysics (UW-GG). The USGS continues its research into the uranium ore forming processes and the geology and geochemical changes that take place during extraction and processing.

The aim is to develop environmentally sustainable methods that will benefit the recovery and restoration processes associated with in-situ recovery of uranium (ISR). Tanya Gallegos, USGS - Denver, continues to lead a study entitled "Impacts of Uranium Mining/Milling on Groundwater and Remediation with Mackinawite."

Certain sulfides, either natural or introduced, can aid the groundwater restoration process by hastening the necessary reduction required to stabilize minerals such as uraninite. The iron sulfide mackinawite, and possibly similar minerals, may prove useful in precipitating uranium and other metals in order to return the groundwater to pre-mining conditions. In future research, Gallegos hopes to explore other areas such as 1) characterizing core samples from an ISR operation to determine elemental associations with uranium, 2) laboratory simulation of ISR to extract uranium

and characterize solids in the system, and 3) simulated remediation using mackinawite and its effectiveness on fixing uranium and other metals (more).

In cooperation with active Wyoming uranium mining operators, the WSGS and the UW-GG have acquired well-controlled samples of pre-mineralized, mineralized, and post-mineralized host sandstones and also plan to study associated native waters. Investigators on this project are Susan M. Swapp, Robert W. Gregory, B. Ronald Frost, Carol D. Frost, Jonathan F. McLaughlin, Davin Bagdonas, Charles Nye, and William White. They are using field emission scanning electron microscopy (FESEM), powder x-ray diffraction (XRD), wavelength dispersive x-ray analysis (WDS) on an electron probe micro analyzer (EPMA), x-ray fluorescence (XRF), stable isotope mass spectrometry, and traditional wet chemical analyses at UW-GG to characterize host rocks, native ground waters, and uranium minerals in these deposits.

These data, together with radiogenic isotopic data for accessory minerals acquired using instrumentation at Stanford University will enable the team to recognize potential source areas for the uranium in individual deposits. Identification of uranium mineralogy will hopefully facilitate more thorough and effective ISR mining processes, and a better understanding of uranium source rocks and controls on deposit formation will enhance prospecting and initial evaluation of new deposits. The study will end in June, 2014.

In September, 2012, I presented a talk at the Rocky Mountain Section of AAPG in Grand Junction entitled “Aspects of Ore Genesis at the Lost Creek Uranium Deposit, Sweetwater County, Wyoming.” This was a brief update on the above mentioned study with WSGS and UW-GG presenting some of our preliminary findings, questions, and a summary of the direction in which we would like to proceed. I have also presented talks on uranium in Cretaceous rock formations, the past, present, and future of the uranium mining industry, at local/regional geologic meetings and conferences, as well as to younger audiences looking into careers in the energy industry.

Also at the WSGS, Wayne M. Sutherland, Brett Worman, Jacob Carnes, and I completed a reconnaissance survey of potential rare earth element (REE) deposits and anomalous occurrences. Follow-up studies on known sites with anomalous REE values were visited and resampled, not only for REE but also other potential minerals of potential economic value. Additionally, we sampled dozens of sites around Wyoming which may have potential for REE occurrences based on what is known about existing deposits in Wyoming and elsewhere.

The study also involved data mining at WSGS and beyond, as well as testing of geologic samples collected in conjunction with past WSGS investigations but for which REE was not the focus. The project was completed in June, 2013 and is summarized in WSGS Report of Investigations RI-65, available through our website (more). All field and geochemical data was compiled into an interactive database which is also now available to the public by way of the WSGS web site (here).

During the period, Susan Hall, USGS, Denver, selected the Gulf Coast Uranium Province and the western portion of the NURE Coastal Plain Uranium Resource Region for review of the assessment methodology used in the NURE program of the 1970s and 1980s as part of the evaluation of potential assessment strategies to adopt for the new assessment. Based on production records and reserve estimates tabulated for the region, most of the production since 1980 is likely from the reserves identified by NURE. The potential resource predicted by NURE has not been developed, likely due to a variety of factors related to the low uranium prices that have prevailed since 1980 (more).

STATUS OF THE THORIUM INDUSTRY

The American thorium dream, which the U.S. government pursued in tandem with the uranium-fueled reactors throughout the 1960s, went more or less entirely burst in 1973. This despite the successful testing of a thorium-fueled facility, built at Oak Ridge National Laboratory, and some evidence suggesting that thorium was a safer, more abundant fuel. Research was halted, and uranium-fueled reactors emerged as the standard (more). The I2M Associates Web Portal provides up-to-date articles and reviews of current and historical thorium activities (more).

China is incorporating older American research to pursue a safer reactor based on thorium (more). A Norwegian company is breaking with convention and switching to the alternative energy it hopes will be safer, cleaner and more efficient. They deal with the using thorium in the fission process.

If a car were powered by a thorium-based system, there would be no need to refuel it. The vehicle would not last as long as the energy source. The thorium would be energetic so long, in fact, it would be useful for 100s if not 1,000s of years. That's why **Laser Power Systems** has created a concept for a thorium-powered car engine. The element is radioactive, of course, and the team uses it to build a laser beam that heats water, produces steam, and powers an energy-producing turbine, i.e., producing electricity.

Thorium metal is one of the most dense on the planet. A small sample of it packs 20 million times more energy than a similarly-sized sample of coal, making it an ideal energy source. Dr. Charles Stevens, the CEO of Laser Power Systems, told the press that thorium engines won't be in cars anytime soon (more). "Cars are not our primary interest," Stevens said. "The automakers don't want to buy them." He said too much of the automobile industry is focused on making money off of gas engines, and it will take at least a couple decades for thorium technology to be used enough in other industries that vehicle manufacturers will begin to consider revamping the way they think about engines….unless a Henry Ford appears on the scene in the U.S. in the meantime.

"We're building this to power the rest of the world," Stevens said. He believes a thorium turbine about the size of an air conditioning unit could more provide cheap power for whole restaurants, hotels, office buildings, even small towns in areas of the world without electricity. At some point, thorium could power individual homes. Stevens understands that people may be wary of thorium because it is radioactive, but any such worry would be unfounded. "The radiation that we develop off of one of these things can be shielded by a single sheet off of aluminum foil," Stevens said. "You will get more radiation from one of those dental X-rays than thorium." (more).

Thorium would probably prove to be safer in reactors than uranium. Nuclear scientists are being urged by the former U.N. weapons inspector Hans Blix to develop thorium as a new fuel (more). And, thorium fuel is now being tested in the Halden research reactor in Norway. It was loaded in the last week of April (2013), defining the start of a physical test program that will simulate how it operates in a power reactor. Led by Norwegian company **Thor Energy**, the test will provide unique information necessary for qualifying this new fuel material for commercial use in current reactors (more).

The thorium fuel is in the form of pellets composed of a dense thorium oxide ceramic matrix containing about 10% of finely blended plutonium oxide as a 'fissile driver'. As a mixed-oxide (MOX) fuel variant, it is familiar to the nuclear industry, but thorium-MOX fuel has certain advantages compared to the uranium-MOX fuels in use at some reactors around the world. It promises higher operating safety margins due to higher thermal conductivity and melting point, and produces no new plutonium as it operates. **Thor Energy** personnel pointed out that thorium-plutonium fuels provide a new option for reducing civil and military plutonium stocks.

Officials in India are considering building a large-scale prototype of a reactor fueled by a combination of thorium and low-enriched uranium. Ratan Kumar Sinha, chairman of the Bhabha Atomic Research Center in Mumbai, recently told the U.K.'s *Guardian Newspaper*, "The basic physics and engineering of the thorium-fueled Advanced Heavy Water Reactor are in place, and the design is ready." He said the Indian Government has begun a six-month search for a site for the 300-megawatt reactor while conducting confirmatory tests on the final design (more).

India's Advanced Heavy Water Reactor design would use the country's abundant thorium supply. Sinha said the reactor could be operational by the end of the decade. One of the three elements widely considered being useful in the generation of nuclear energy, thorium is three to four times more plentiful than uranium and is widely distributed in nature. India has one of the world's largest thorium deposits.

However, the element cannot be used alone in a reactor because it cannot undergo fission to release energy. It can be converted inside a reactor into the fissile isotope ^{233}uranium when used with other fissile material such as ^{235}uranium or ^{239}plutonium. Only a relatively small amount of

uranium or plutonium is needed to convert thorium to uranium, because the thorium will continue to create more fuel during normal operation in the reactor. (more)

TerraPower, the Bill Gates-chaired nuclear power company, has garnered substantial attention for pursuing traveling-wave reactor technology (more), which runs entirely on spent uranium and would rarely need to be refueled. But the firm just quietly announced that **TerraPower** is going to start seriously exploring thorium power as well (more). He wouldn't say more, but Gilleland was talking about molten salt reactors, which are considered by many to be safer than the conventional pressurized water reactors currently operating in the United States, especially when they run on thorium. Gilleland said that their emphasis remains on the traveling-wave technology, but that thorium was definitely receiving some renewed attention (more).

Alternative Fuels Use in South Africa

North-West University Nuclear Materials and Thorium research group leader Anthonie Cilliers (2013) maintains that using thorium and uranium in tandem in a reactor is a more efficient fuel stock, should the nuclear build program go forward, as the nuclear plant can be run for up to 24 months between fuel cycles with the same amount of thorium fuel, as opposed to the 18-month cycles being undertaken at Koeberg.

When considering how thorium can be used in tandem with uranium in a pressurized water reactor, the same reactor technology employed at Koeberg, Cilliers and his research team proposed the replacement of a percentage of the ^{238}U (filler uranium that does not fission) with thorium in the reactor, while maintaining the same amount of ^{235}U (the fuel that runs the plant and fissions) per volume (more). “During the 18 months between refueling schedules, the ^{238}uranium absorbs neutrons and turns into plutonium – the fuel that sustains the process up to the 18 months.”

Thorium, while working in a similar way, also absorbs neutrons, but instead of turning into plutonium, it turns into ^{233}uranium – a better breed of fuel.

“It is this ability that enables thorium fuel stock to run the plant for longer on the same amount of fuel,” highlights Cilliers, adding that it is this feature that will ultimately be the driving force behind the adoption of the technology in South Africa.

Reactor Technology and Safety

Koeberg is one of the last Generation II nuclear plants that was built and, since then, Generation III nuclear technology safety precautions have been significantly improved, says Cilliers. Stress tests have been carried out on the new Generation III plants, subsequent to the Fukushima Daiichi nuclear disaster, which was initiated primarily by an earthquake and tsunami on March 11, 2011.

As a result of the nuclear disaster, several passive and fail-safe cooling systems have been incorporated into the Koeberg reactor.

Cilliers indicated that while the earlier-generation nuclear technologies were designed with accident scenarios in mind, the new-generation plants have been tested for beyond-design-based accident scenarios, should something go wrong, the plants are designed to fail in a safe mode, rather than an unknown mode (more).

Meanwhile, the Nuclear Industry Association of South Africa (NIASA), the mandate of which is to promote nuclear power generation as part of South Africa's energy mix, supports the bid by Martins to ensure the future of energy security in South Africa. The association concluded that investment in nuclear power goes beyond this mandate and that it will lift South Africa to a new level of human capacity and high technology growth.

NIASA maintains that, although nuclear is more expensive than coal and gas to build, nuclear plants are cheaper to run, with nuclear fuel costs amounting to about 5% of the overall generation costs.

The Koeberg nuclear power station and the proposed 9,600 MW complement of new nuclear power will require about 102, 000 tons of uranium over their combined lifetimes. Should South Africa require an alternative to uranium, thorium, a rare earths by-product, can be considered as a replacement for uranium in the longer term, if required. Alternatively, uranium and thorium can be used in tandem for future generation reactor types (more).

For additional information on thorium activities in the U.S., Canada, and elsewhere, see (here).

STATUS OF THE RARE EARTH INDUSTRY

The EMD Mid-Year Report for 2011 (2011) offers the uninitiated an introduction to the rare earth commodities. That report covers the list of 17 rare-earth elements (REEs), their geological origins and distribution, production, prices, and explores some of the geopolitical issues involved, with a brief description of the REEs on the Moon. That report also contains numerous references on REE deposits. The I2M Associates Web Portal provides up-to-date articles and reviews of current and historical activities on REEs (more).

This report summarizes current exploration and development activities underway on rare earths in various parts in the U.S. and elsewhere in the world. "Burdensome red tape, duplicative reviews, frivolous lawsuits and onerous regulations can hold up new mining projects here in the U.S. for more than 10 years," *The Hill* reported the House Natural Resources Committee Chairman Doc Hastings (R-Wash.), as stating. "These unnecessary delays cost American jobs as we become more and more dependent on foreign countries for these raw ingredients.

The U.S. House of Representatives has passed legislation that would speed up mining and exploration permit approvals, but the law is by no means assured passage by the Democrat-controlled Senate. Known as the *National Strategic and Critical Minerals Production Act*, the bill was passed 246 to 178, with just 15 Democrats in favor. In the last Congress, 22 Democrats supported a similar bill.

The act would give federal agencies a maximum 30 months to decide on whether to approve or reject permits for exploration and mining, and it limits the ability of opponents to use courts to stop mining. Republican supporters of the bill say the legislation is needed to speed up mining approvals, to ensure that the U.S. has adequate sources of strategic minerals such as rare earths. Locally sourced strategic minerals would break U.S. dependence on other countries, such as China, on importing the materials, used for defense and other applications.

The general consensus is that as China continues to tighten global supplies of rare earth elements, the U.S. should respond with an American mineral mining renaissance that will bring back mining of strategic minerals and associated downline manufacturing to the U.S. (more).

Of particular note is that a global race is underway to develop increasingly important deposits of rare earth elements and Canadian producers are planning to up their stake in the REE industry (more). Detailed reports are available on a variety of rare earth mining and downline usage in Chinese permanent magnet, metal smelting, metal rolling processing, production and manufacturing are available (here).

REEs are used in everything from energy efficient technologies like hybrid vehicles, wind turbines and solar panels to cell phones and magnetic resonance imaging [MRI] machines. As technology advances and more pressure are placed on finding new sources of energy, the demand for REE will also increase (more).

A new cooperative network has been formed in Canada with the hope of establishing production within five years. The Canadian Rare Earth Element Network (CREEN) aims to have Canadian producers and processors supplying at least 20 percent of anticipated global demand for the critical material by 2018 (more).

China has continued to witness the suspension of mine and plant production by a number of companies as they comply with new environmental regulations, according to Judith Chegwidden of **Roskill Consulting Group** at a recent conference. The big excitement on the supply side this year has been the long-anticipated start-up of production by Australia's **Lynas Corp** (more) (capacity of 11,000 tpy rare earth oxides (REOs)) and **SARECO** (more) in Kazakhstan (1,500 tpy REO capacity), in conjunction with the ramp-up of production at existing producers such as **Molycorp** (more) of about 19,000 tpy REO capacity (more).

China Daily reported recently that six of China's rare earth producers: **Baotou Steel Rare Earth Hi-Tech Co** (more), **China Minmetal Rare Earth Co Ltd** (more); **China Nonferrous Metal Industry's Foreign Engineering and Construction Co Ltd** (more); **Chinalco Rare Earth Jiangsu Co Ltd**; **Rising Nonferrous Metals Co Ltd** (more), and **Ganzhou Rare Earth Mineral Industry Co Ltd.** (more), are on the list of vendors (more). The material will supply China's strategic minerals stockpile, which began last year. Most of the REEs will be higher-value medium and light rare earths, as opposed to the cheaper light rare earths, said *China Daily*. Furthermore, Chinese stockpiling (*vis-à-vis* withholding from the market) may be in the future (more).

The news sent the prices of several REE companies that trade on stock exchanges into double-digit increases, with **Avalon Rare Metals** leading the increase (more). The company with its flagship Nechalacho Deposit at Thor Lake, Northwest Territories, gained 11 percent, adding to an 80 percent spike over the last three months, as noted MINING.com. Other gainers included **Tasman Metals** (more), **Texas Rare Earths Resources** (more), **Rare Element Resources** (more), and ASX-listed **Peak Resources** (more), which is exploring the Ngualla rare earth project in Tanzania (more).

The permanent magnet market is witnessing very high growth on account of rising demand for efficiency and increased electrification in all facets of life. The demand for permanent magnets is growing, especially from the automotive and wind energy sectors. It is increasingly used for electric power steering, electric vehicles, and hybrid vehicles. The wind turbine market is another major growth area for permanent magnet. China is a dominant player in the rare earth permanent magnet (more).

Permanent magnet are made of diverse materials that range from ferrite to rare earth elements (e.g., NdFeB, Ferrite, SmCo, and Alnico). NdFeB permanent magnets, due to their wide range of applications and numerous advantages, are used in most of the industries. Hence, they dominate the market. Presently, China has the monopoly in the supply of rare earth minerals that are necessary to produce rare-earth magnets. It has huge reserves of rare earth minerals that account for 23% of the world's total rare earth reserves. China produces a vast quantity of two primarily important rare earth minerals required to produce, i.e., dysprosium (production share of 99%) and neodymium (production share of 95%).

The Chinese government is taking strategic steps to maintain its leading position as a supplier of rare earth minerals as well as to secure rare earth reserves for its own internal consumption. It has restricted rare earth annual export quotas to less than 35,000 tonnes. The Chinese government is also taking measures to curb non-licensed mining and export of rare earth minerals. The supply constraints from China results in high volatility in the prices of rare earth minerals that results in high prices for rare earth magnets (more).

Other Company Activities

Quest Rare Minerals is planning on building a processing plant worth US$1.3 billion at its Strange Lake mine. The news follows the release of a prefeasibility study on the project in October (more). The plant will be based in Bécancour, in Québec. According to Quest, it will create more than 300 full-time jobs once the plant is up and running, as well as 500 during construction.

"One of the reasons we have chosen Bécancour for our processing plant is its highly-skilled work force with extensive experience in heavy industries," says Peter Cashin, Quest's president and CEO. He adds that the company is expected to employ dozens of engineers, metallurgists and geologists (more). The study estimates the project has a net present value of $2.9 billion before tax, with a 25.6 percent internal rate of return.

The mine would cost an estimated $2.57 billion to construct, have a mine life of 30 years, and generate, on average, $1.047 billion in revenue per year. According to Quest, the study provides for the construction of a hydrometallurgical plant in southern Quebec to process ore shipped from Strange Lake and to produce four separated products, a mixed heavy rare earth elements plus yttrium (HREE+Y) oxide concentrate, high-purity zirconium basic sulfate (ZBS, for further downstream processing), high-purity niobium oxide, and a mixed light rare earth double-sulfate concentrate (more).

U.S. Rare Earths, Inc (UREE), with mining claims in Idaho, Montana, and Colorado, announced today an extension of its 2013 drilling and exploration program on its Last Chance Mine property. UREE will also initiate a new drilling and exploration program on its North Fork property in an area previously unmapped and undrilled. Drilling has identified significant grade percentages of Critical Rare Earth Oxides (CREO) dysprosium, terbium, europium, neodymium and yttrium, and Total Rare Earth Oxides (TREO).

The Last Chance Mine property, located near the mining belt of east-central Idaho and west-central Montana is uniquely positioned for re-entry and development of a processing facility to create American jobs. Continuing exploration is focused on upgrading other historic data and defining new areas located throughout the trend in advance of mining and development of our separation mill (more).

Search Minerals and subsidiary **Alterra Resources** announced recently that they have discovered 10 new prospects in the Port Hope Simpson rare earth district in Labrador. Search personnel indicated that the mineralization is similar to its Foxtrot project for which an updated preliminary economic assessment was filed in May (more). The Critical Rare Earth Oxides include:

- Dy values range from 181 to 295 ppm; Dy (208 to 339 ppm Dy_2O_3) [vs. 189 ppm Dy (217 ppm Dy_2O_3) for the **Foxtrot** resource];

- Y values range from 1,023 to 1,475 ppm; Y (1,299 to 1,873 ppm Y_2O_3) [vs. 1,040 ppm Y (1,321 ppm Y_2O_3) for the **Foxtrot** resource];
- Nd values range from 1,417 to 2,050 ppm; Nd (1,653 to 2,391 ppm Nd_2O_3) [vs. 1,442 ppm (1,681 ppm Nd_2O_3) for the **Foxtrot** resource]; and
- HREE + Y values range from 19.64% to 27.87% [vs. 19.76% for the **Foxtrot** resource (more)].

Avalon Rare Metals Inc., the company seeking to develop rare earth mining at Thor Lake, about 100 km southeast of Yellowknife, has taken another step forward towards production. The environmental assessment recommendations by the Mackenzie Valley Environmental Impact Review Board have been approved.

"The EA is seen as a big risk factor with investors," Avalon president and CEO Don Bubar told The Hub. "That uncertainty has now been removed."

Rare earth metals are ubiquitous in many new technologies from magnets that power turbines to the touch screens on smartphones, but China currently controls the world's supply of the minerals. While there is an exploration camp on the shores of Thor Lake, the Nechalacho Rare Earth Elements Project (more) needs to raise funds before moving on with production (more).

Advances in Technology?

Rare Element Resources Ltd., a mineral resources company advancing development of the Bear Lodge Critical Rare Earth Project, is pleased to announce that its pilot plant test program, conducted at SGS Lakefield Canada, validated the significant benefits of the Company's proprietary processing technology and identified the opportunity for additional Project improvements (more).

The pilot test work focused on confirming the flow sheets for both the PUG and Hydromet process. The plant tested four different ore types, with total rare earth oxide (TREO) head grades averaging 4.8% from Bull Hill deposit and 2.7% from Whitetail Ridge deposit. The work was conducted over a four-week period at a production scale of 240 kg/day. During testing, approximately 97% of total REEs were selectively separated in the oxalate precipitation process, with about 98 to 99% of the total base metals and silica remaining in the barren solution. Because of the base metal concentration, it should be possible using a crystallization acid distillation process to beneficiate base metals separately. The potential value of these byproducts to the Company will be evaluated (more).

The Lofdal Rare Earths Project – Windhoek, Namibia – A Special Look At Namibia Rare Earths

Namibia Rare Earths Inc. is a Nova Scotia, Canada-based mineral exploration and development company with a 100% ownership stake in the Lofdal Rare Earth Project located in Namibia. Recent resource estimates completed on the project have proven the high-value content of heavy

rare earths. The exceptional level of heavy rare earths enrichments puts the Lofdal project in a class by itself, and may provide the site with the largest reserves of heavy rare earths outside of China.

The company is well financed, carries no corporate debt and has an experienced management team with a proven track record of mine development. The project resides in Namibia, which was considered by a recent Fraser Institute report to be the 10th best mining jurisdiction in the world (more).

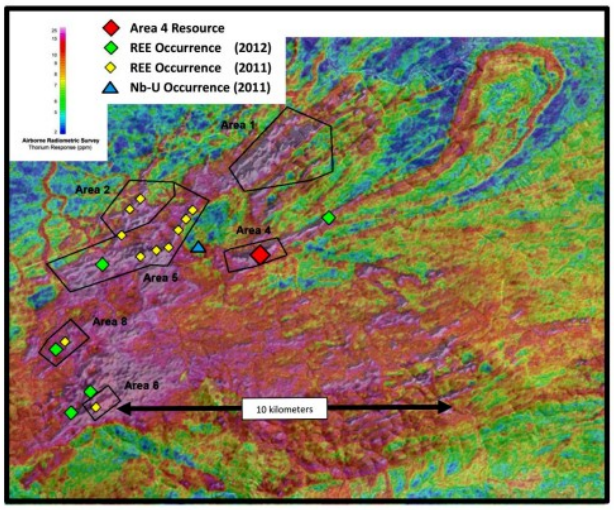
The **Lofdal Rare Earths** Project is located approximately 450 kilometers northwest of the capital city of Windhoek, Namibia (see map below). The Lofdal Rare Earths Project property covers a total of 573 square kilometers centered on the Lofdal carbonatite complex.

Rare earth element mineralization at Lofdal is closely associated with the carbonatite dykes and related hydrothermal alteration. Of particular interest is the frequent enrichment of heavy rare earths in mineralized zones. It is thought that the heavy rare earth-rich mineralization is dominantly a hydrothermal event, that occurred relatively late in the history of the 2 billion year old complex.

The Lofdal Rare Earths Project has been developed over a very short period of time since the recognition of the underexplored mineral district in 2008. From discovery of enriched REE zones in 2010, to the delineation of a first mineral resource in 2012 marks the relative speed of the project's development. The potential of Lofdal to host a number of new rare earth deposits, particularly, deposits with exceptional zones of heavy enrichment is substantial, see figure below.

Click to Enlarge

In 2010, a detailed exploration confirmed areas with some of the highest levels of heavy rare enrichment known in the world. The objective of the program was to identify a suitable target for the development of an NI 43-101 compliant mineral resource estimate by mid-2012 (more).

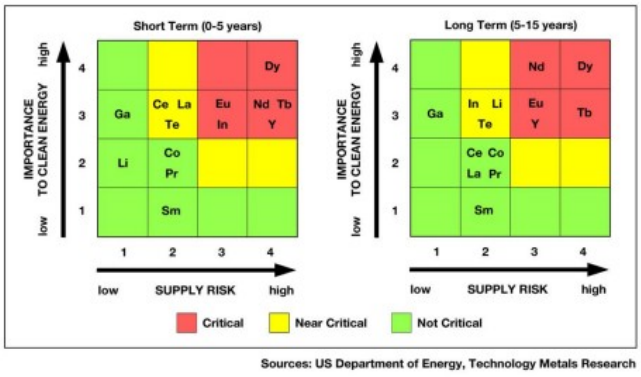


Magnetics Map (click to enlarge figure)

The resource estimate completed by **Namibia Rare Earths** in Area 4 in above figure comprises an Indicated resource of 900,000 tonnes at a grade of 0.62% total rare earth oxide (TREO) with 86% heavy rare earth enrichment and an Inferred resource of 750,000 tonnes at a grade of 0.56% TREO with 85% HREE, using a 0.3% cut-off.

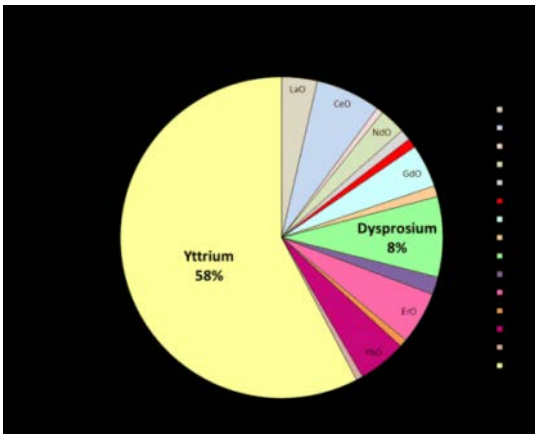
Value of Heavy Rare Earths

The U.S. Department of Energy has identified dysprosium, neodymium, terbium, europium and yttrium as the most critical rare earths. They have defined “criticality” as a measure that combines importance to the economy and risk of supply disruption (see figure below). Currently more than 95% of production of rare-earth metals is based in mainland China and predictions from the European Union raise concerns that, in the long term, China may only be able to produce enough heavy rare-earth metals to satisfy its own needs. This may trigger a significant supply shortage for the rest of the world.

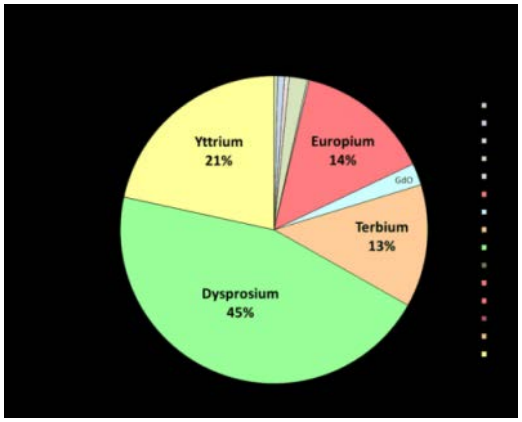


Criticality Index (click to enlarge figure)

Heavy rare earths are an integral part of the both clean energy technology and data storage; both of these areas are expected to increase substantially in the next five years. The "big four" of dysprosium, yttrium, terbium, and europium are abundant at Lofdal; with the majority of the deposit's value based on these four heavy metals alone (more).



Distribution of Heavy Rare Earths within the Deposit



Dollar Value of Heavy Rare Earths within the Deposit

Dysprosium only comprises 8% of the rare earths mix at Lofdal, but because of its high price, it represents 45% of the value of the deposits (more).

For additional information on rare earth activities in the U.S., Canada, and elsewhere, see (here).

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