



# Uranium Report 2018

**Everything you need to know about uranium!**



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# Preface

Dear Readers,

on the following pages, we present to you with pleasure the second update of our uranium report. Uranium is a “hot” topic and many people don’t like to say the least and some hate it. But without uranium there would be a major problem with the base load energy supply in the world and e-mobility would be still a dream of the future. Swiss Resource Capital AG has made it its business to topically and comprehensively inform metals and commodity investors, interested parties and the individual who wants to become an investor in various commodities and mining companies. On our website [www.resource-capital.ch](http://www.resource-capital.ch) you will find 20 companies and information as well as articles related to commodities. Our series of special reports started with lithium and silver. Now we move on to uranium as it is the energy metal of the future whether we like it or not. Wind and solar energy are very often not cost effective nor really energy efficient considering the complete energy balance including the amount of energy used to build it. This report shall give the reader an idea about the real facts of the uranium industry and the energy supply from nuclear power worldwide. China especially needs nuclear power plants to solve its air pollution problems because most of the electrical energy is generated by coal power plants. Today around 450 nuclear power plants are in operation in more than 30 countries globally and 70 are under construction. Over 163 nuclear power plants are planned or ordered by 2040 and if we all want to drive with emission free e-cars, bikes or motor scooters we need those nuclear power plants urgently as we cannot reliably generate the necessary extra power with wind and solar alone. Concurrently several of the top uranium producers have announced to reduce their production by 2018 to lift the uranium spot price to a level that is necessary for the survival of most of the companies and to put pressure on the energy companies to renegotiate soon expiring delivery contracts.

We also interviewed the experts Scott Melbye and Dr. Christian Schäfer about the uranium markets and the future prospects. Of course, we present you some interesting companies from this industry sector with numbers and facts. The combined market cap of all uranium companies is only around US\$10 billion worldwide, a crazy small market with a fascinating outlook. Climate change and clean air require nuclear energy. “There’s really only one technology that we know of that supplies carbon-free power at the scale modern civilization requires, and that is nuclear power” – Ken Caldeira of Stanford University’s Department of Global Ecology.

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Yours Jochen Staiger



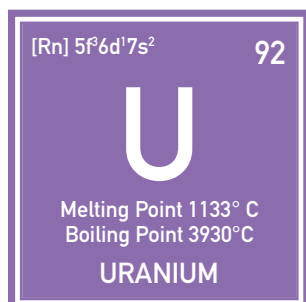
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Tim Roedel is chief-editorial- and chief-communications-manager at SRC AG. He has been active in the commodity sector since 2007 and held several editor- and chief-editor-positions, e.g. at the publications Rohstoff-Spiegel, Rohstoff-Woche, Rohstoffraketen, Wahrer Wohlstand and First Mover. He owns an enormous commodity expertise and a wide-spread network within the whole resource sector.

# Satisfying the Hunger for Energy and improving the Carbon Footprint at the same time? – Nuclear Energy can combine both!

The global energy demand has multiplied since the end of the 1980s, especially due to the emerging countries and in particular the BRIC countries Brazil, Russia, India and China. About 11.5% of the total energy demand is met by nuclear energy. Fossil fuels like coal and oil are still burned for energy production. The difference in the situation of 25 years ago is the increasing demand for reduction of CO<sub>2</sub> emissions and the more noticeable phenomenon of “global warming”. In particular, the energy consuming industrial nations and the emerging countries must increase their energy efficiency and improve their carbon footprint in the coming years. This cannot be achieved by burning coal and oil. The alternatives are renewable energies - which need tremendous time and cost expenditures - or nuclear energy which can provide lot of energy CO<sub>2</sub> neutral. This possibility of the fast and almost clean energy generation has long been recognized by some countries who are increasing the construction of new nuclear power plants.



## Supply Gap inevitable in the future

Today only 90% of the global uranium demand can be satisfied by producing mines. The number of nuclear reactors will double in the coming 10 to 20 years. The previous main supplier of uranium – Russia’s nuclear weapons arsenal – doesn’t exist anymore. Where will the needed uranium come from? The existing mines can be expanded and new mines opened but not at the current uranium spot price of around US\$ 21 per pound. An enormous supply gap seems to be inevitable at least at the current market price. That is the situation investors should be aware of – a sharply rising uranium spot price and an inevitable connected second uranium boom.

## What is Uranium?

### One of only two elements that can sustain nuclear fission chain reactions

Now for some information about the element uranium itself. Uranium was named after the planet Uranus and is a chemical element with the element symbol U and the atomic number 92. Uranium is a metal whose isotopes are radioactive. Naturally occurring uranium in minerals is comprised of the isotope 238U (99.3%) and 235U (0.7%).

The uranium isotope 235U is fissile by thermic neutrons and besides the very rare plutonium isotope 239Pu, the only known natural occurring nuclide that is suitable for nuclear fission chain reactions. Therefore, it is used as a primary energy source in nuclear power plants and nuclear weapons.

## Occurrence

Uranium does not occur pure in nature but always in form of oxides in minerals. There are some 230 uranium minerals that could locally be of economic importance.

There is a large range of uranium deposits from magmatic hydrothermal to sedimentary types.

The highest uranium grades are encountered in unconformity-type deposits with average uranium grades of 0.3 to 20%. These deposits are mined by the two largest uranium producers. The largest single uranium resource in the world is Olympic Dam with a proven uranium content of more than 2 million tons at an average uranium grade of 0.03%. The first industrial scale uranium mine in the world is in Jachymov (Czech Republic) produced from hydrothermal veins.

According to the International Atomic Energy Agency (IAEA) the largest uranium reserves are in the USA, Niger, Australia, Kazakhstan, Namibia, South Africa, Canada, Brazil, Russia, Ukraine and Uzbekistan.

## **Short outline of the history of the commercial uranium industry**

### **From the beginnings to the first atomic bomb**

Uranium was produced for the first time as a by-product in Saxon and English mines at the beginning of the 19th century. Until the 1930s there was little use for the radioactive raw material. It was used for coloring glass and ceramics as well as in photography. The shadowy existence of the uranium changed suddenly as Hitler came into power in Germany, and an unprecedented spiral of armament and testing of new weapons technologies began. Above all the “Third Reich” accelerated the expedited mining of uranium. These mining activities were exclusively in the region of Jachymov (the German name is Sankt Joachimstal) in today’s Czech Republic. The German supply submarine U-234, that was seized by two U.S. destroyers two days after the end of the war and towed to the USA had uranium ore from Jachymov on board. According to leading U.S. scientists, parts of this uranium ore were used to build the Hiroshima atomic bomb.

### **The Cold War makes Uranium acceptable**

The newly created uranium sector had its biggest boost after the Second World

War due to the beginning of the Cold war. The victorious powers of the Second World War, which rivaled for global dominance, now needed the highest possible number of nuclear weapons and also vast quantities of uranium. This resulted in a systematic exploration for useable uranium occurrences in all states of the USA. The previous Atomic Energy Commission (AEC) had the exclusive right to buy all of the produced uranium in the USA for over three decades. The greed for more and more nuclear armament led to extreme high prices per pound of uranium for those days. As a result, the search for uranium was conducted in all U.S. states in the 1950s and 1960s. The USA had a strong uranium industry at the end of the 1960s that was a global leader from mining to enrichment.

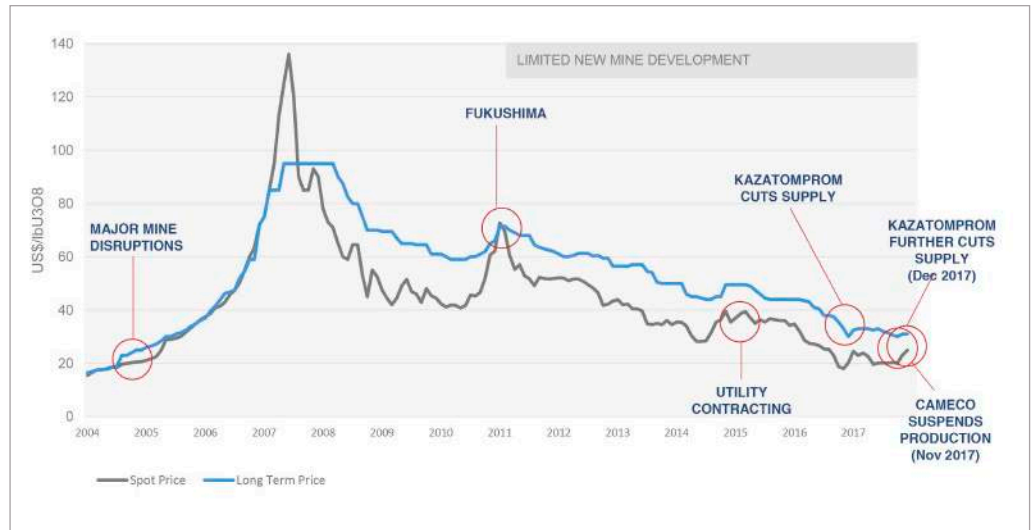
The Soviet Union initially expanded existing uranium mines in East Germany and Czechoslovakia. This was necessary because Russia had no knowledge of uranium occurrences in its own country until the end of the Second World War. In the 1950s and 1960s Russia began with a uranium exploration which led to large discoveries in Siberia and Kazakhstan.

### **Rise and temporary slump of civilian use of uranium**

Already in 1953, the former U.S. president Eisenhower conceived a program for the civilian use of uranium. “Atoms for Peace” should find their way in the energy generation, medicine, traffic and agriculture and resulted in the demand for additional amounts of uranium. The civilian nuclear power had its beginning and was quickly advanced by other nations. After a 25-year long uranium boom concerns have been increasingly voiced warning of the appearing lack of security in many nuclear power plants. After the almost Maximum Credible Accident in the American nuclear power plant Three



Historical development of the uranium prices, the uranium production and important events. (Source: Laramide Resources)



Mile Island and the Super Maximum Credible Accident in Chernobyl, the general public turned its back more and more to nuclear power. In addition, the collapse of the Soviet Union resulted in a building stop of nuclear weapons and therefore no further uranium was needed.

Many nations decided not to install new nuclear reactors and some countries switched off existing reactors. Almost 90% of all uranium mines were closed because the market price for uranium had fallen to US\$ 5 per pound in the meantime. The uranium for the operation of the still existing reactors came from old stockpiles or Russia's disarmament program.

## Uranium Production

Basically, there are two uranium production methods: the conventional production and the production via in-situ leaching or rather in-situ recovery (ISR). The exact mining method depends on the properties of the ore body, (like depth, shape, ore content, tectonic) and the type of country rock as well as other factors.

## Conventional Production

The majority of the uranium is mined in underground mines. The deposits are developed via shafts, drifts, ramps or spiral declines. Ingressing groundwater and the ventilation of the mine often pose problems. The exact production method is chosen according to the characteristics of the deposit. The form of the orebody and the distribution of the uranium in it are especially pivotal. An orebody can be specifically mined by underground methods where less waste material is produced as by open pit methods. Ore bodies near the surface and very large ore bodies are primarily mined by open pit mining methods. This enables the use of low cost large equipment. Modern open pit mines can have a depth from a few to over 1,000 m and a diameter of several kilometers. Open pit mines often produce large amounts of waste material. Like in underground mines, large amounts of water have to be drained from the open pit however the ventilation is less problematic.

## ISR Mining

The ISR method uses injection wells to pump water and small amounts of CO<sub>2</sub> and oxygen into the sandstone horizons to leach out the uranium. From recovery wells, the pregnant solution is pumped to the surface for processing. The whole method takes place completely underground. The advantages of this method are obvious: there are no large earth movements like in open pit mines, no waste rock stockpiles or tailings ponds for heavy metals and cyanide. At the surface only the wells are visible and the area around the wells can be used without constraints for farming. With the ISR method low grade deposits can be economically mined, the capital costs for the mine development is significantly reduced. The whole method can be implemented with a minimum of manpower which reduces drastically the operating costs. According to a study of the World Nuclear Association, 25% of the produced uranium outside of Kazakhstan comes from ISR mines.

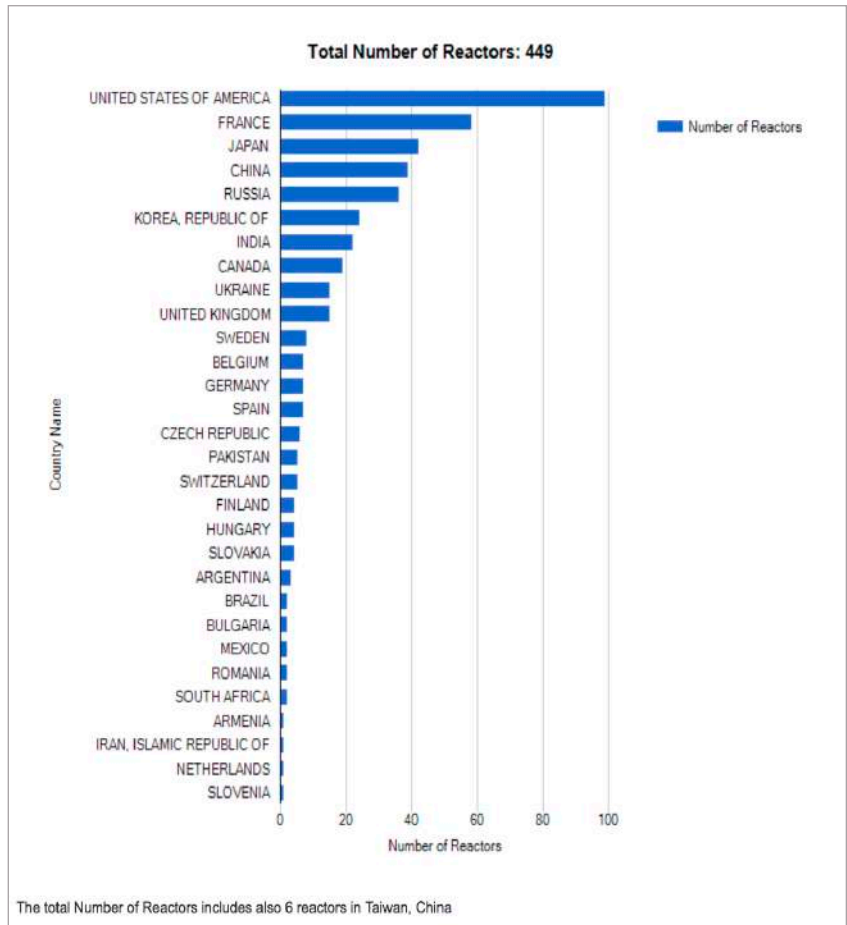
## The current status of the Uranium Market

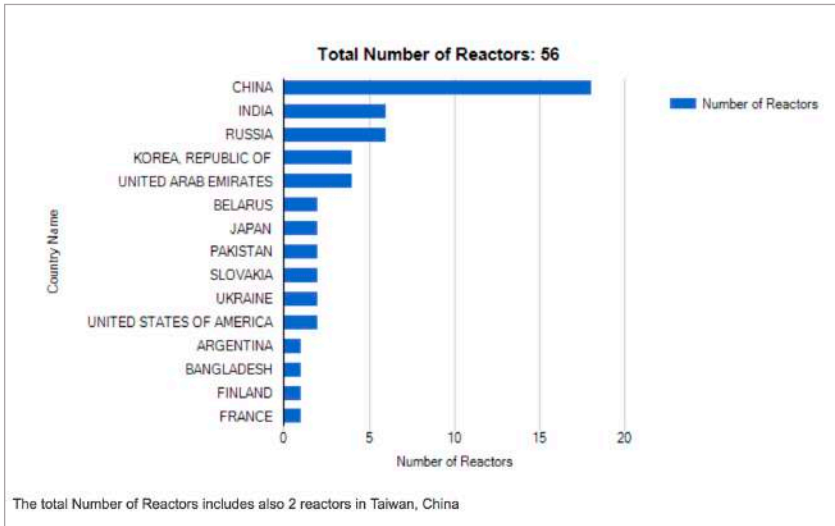
But how does today's uranium market look like? It is certain that the lack of investments into the procurement structure of the past 40 years – in the infrastructure of mines and processing plants – will very likely prove to be a windfall for the uranium investors in the future! Nevertheless, despite opposition against nuclear energy since the catastrophe in Chernobyl and even more after the events in the nuclear plants in Fukushima (Japan) the number of plants worldwide is at a record high. Only 30 countries currently operate (as of March 1st, 2018) 449 nuclear reactors with a total

electrical net output of around 392.5 gigawatts.

The current leading nuclear nation are the USA with 99 running reactors. But this is only half the truth because emerging countries like China and India need more and more energy and have been focusing on a massive expansion of their nuclear power capacities for some time. It is of no surprise that currently 56 additional nuclear reactors are under construction. The planning was completed for an additional 160 reactors and 350 reactors are in the planning phase. After a 20 year stop a renaissance of the uranium sector is pending – especially in China.

Overview of currently operating reactors per country  
(Source: www.iaea.org/PRIS)





Overview of reactors currently under construction per country  
(Source: [www.iaea.org/PRIS](http://www.iaea.org/PRIS))

## Demand situation

### China is only at the beginning of the nuclear age

While many self-appointed experts have predicted the end of the nuclear age, it is only in the development phase in the most populous country in the world. China is operating 39 reactors where most of the electricity is generated by coal power plants. Since the beginning of 2015, 15 new nuclear reactors were put into service. The expansion of the nuclear energy sector in China is enormous and occurs with breathtaking speed! Over two thirds of the Chinese energy consumption is still met by coal power plants. Although China is mining its own coal deposits on a large scale, it is, besides India, one of the biggest coal importer of the world. 30% of the globally produced coal is imported by these two countries. A certain dependency from these coal imports is obvious. This is the point China's leadership wants to avoid. The obligation to implement climate friendly and clean possibilities for energy generation is only secondary matter. In the fall of 2015 the state-owned power

plant manufacturer Power Construction Corporation of China (Beijing) predicted the rise of its country among the biggest user of nuclear energy worldwide the Chinese government is planning the construction of more than 80 nuclear reactors in the coming 15 years and more than 230 new nuclear reactors until 2050. According to information from China Power the new five-year-plan for the energy sector whose approval by the National People's Congress has been planned in March 2016 provides for a faster expansion of the nuclear capacity: to date the capacity was to increase to 58 gigawatts during the coming 5 years, but now over 90 gigawatts are under discussion. In the year 2005 the planning was 40 gigawatts until 2020. Until 2030 110 reactors should be in operation. In the year 2016 alone China started the construction of 6 new reactors. In total 18 nuclear reactors are in the construction phase. According to concepts for the energy sector initial US\$ 75 billion are budgeted for the nuclear expansion. In a second step China's nuclear power generation should be expanded to 120 – 160 gigawatts by 2030! While in Germany the elimination of electricity generation from nuclear energy was decided after the events in Fukushima, China has decided the opposite and will do everything possible to produce electricity by nuclear fission. In light of the rising energy demand – due to the increasing prosperity – and a catastrophic carbon footprint China's approach seems only logical.

### India expands civil nuclear program massively

Besides China, India is the second of the so called "BRIC-Countries" which is pursuing a similar course. The second most populous country in the world plans to expand its nuclear energy capacity by 70 gigawatts. In contrast, India's current to-

tal electrical net output is only around 6.2 gigawatts.

But India has slept through the entry into the nuclear energy and is now desperately trying to search for mineable deposits but has to expand its overloaded power grid at the same time. A tenfold increase of the nuclear energy capacities not only seems to be reasonable but also very necessary.

India doesn't have significant uranium deposits. A tenfold expansion of their own nuclear energy capacities would mean an increase of the total global nuclear electricity generation by 10%.

But where will the additionally needed uranium come from? Currently, only a few of the 22 Indian nuclear reactors are operating with full power. While Japan, China, Russia and South Korea could secure uranium resources worldwide, India missed out completely. Only recently has India entered into offtake agreements with companies from the USA, Canada, Namibia, Kazakhstan, Russia, Great Britain and South Korea.

Currently 6 nuclear reactors are under construction in India and 20 additional will follow until 2030.

### **Russia and Brazil with increasing nuclear capacity**

The two remaining BRIC-Countries, Russia and Brazil have also announced a massive expansion of their nuclear power plants. Currently Russia operates 36 nuclear reactors with around 27.9 gigawatts. 6 reactors are in the construction phase. Furthermore, Russia plans the construction of an additional 26 nuclear power plants which should increase the percentage of the nuclear energy in the Russian energy mix from currently 16% to 19%. In a second step Russia wants to increase this quota to 25%. By the year 2030 Russia wants to build 26 reactors.

Currently Brazil is operating only one nuclear power plant with two reactors. A third reactor is under construction and is expected to be connected to the power grid in 2018. The construction of 4 additional reactors is expected until 2030.

### **Rising global expansion of nuclear energy**

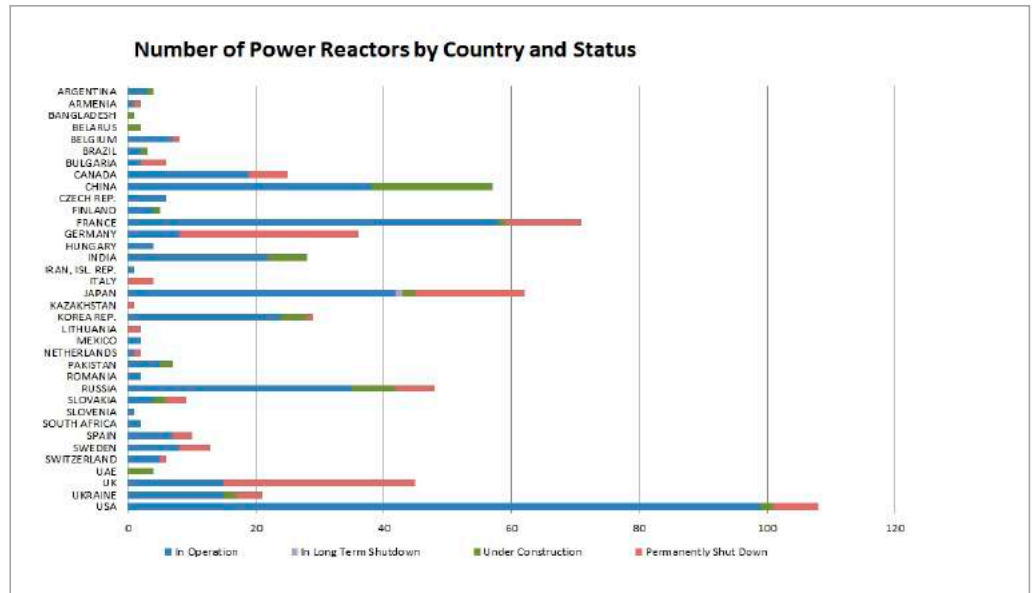
Besides the 30 nations with operating nuclear reactors, 17 additional countries are planning to install nuclear power plants. Among those countries are Egypt, the United Arab Emirates (four reactors under construction), Jordan, Turkey and Indonesia.

### **The USA is close to an energy collapse**

The USA has a special status. With 99 reactors, they have by far the biggest nuclear power plant fleet in the world. Nevertheless, the USA is threatened by a collapse of the energy supply. The USA is still the country with the highest electricity consumption per capita. And the hunger for energy of the Americans is increasing. In addition, the USA is facing the question how to fulfil the CO<sub>2</sub>-reductions which were agreed to in Kyoto and Paris. Because many of the coal power plants were built in the 1950s and 1960s, they are working inefficiently and uneconomically. They have to be shut down sooner rather than later. The electricity consumption is rising continuously. The USA has no choice but to increase the number of its nuclear reactors during the coming years. Of course, photovoltaic plants, wind farms, hydroelectric power plants or geothermic energy provide climate friendly energy, but these energy producers can offer only a partial solution for the pressing energy problems. They are very expensive and their performance is de-

Overview of currently operating reactors (blue), currently shutdown reactors (grey), reactors under construction (green) and permanently shutdown reactors (red). China, India, South Korea, Russia, the United Arab Emirates and the USA are currently working increased at the expansion of their reactor fleet.

(Source: [www.iaea.org/PRIS](http://www.iaea.org/PRIS))



pendent on the time of day and weather. Nuclear energy is therefore the only climate friendly energy generating possibility. In light of the amount of additional electricity demand during the coming two to three decades regenerative energies can only be an addition to the total energy mix.

Therefore, a law for expansion and funding of the energy generation by nuclear energy was created within the “Clean Energy Act of 2009” a program to provide carbon free energy. Both U.S. governing parties worked on a US\$ 18.5 billion plan for doubling of the nuclear power capacities until 2030. At the beginning of 2010 President Obama announced that the U.S. government will provide in the 2011 federal budget additional funds of US\$ 36 billion of government guarantees for the construction of a new generation of nuclear power plants. This would be a tripling of the originally planned budget. During the past years an application for lifetime extension of 60 years total operating time was made for over 60 U.S. nuclear reactors. In addition, there are 40 applications for the construction of new nuclear power plants that should be

connected to the power grid by 2025. Until now only 2 plants are under construction and additional 14 are in a concrete planning phase.

### Long-term supply contracts expire soon

The previous cycle of contract conclusions which was dominated by the uranium price peaks of the years 2007 and 2010 was the reason that the plant operators signed contracts at higher price levels and very long durations of 8 to 10 years. On the one hand, these old contracts are ending and on the other hand the plant operators didn't look for a replacement of such deliveries. The forward contracts of the plant operators are declining and therefore the required quantities for which there are no contractual obligations are increasing and have to be contractually secured in the future. As expected the unmet demand will be just less than one billion pounds of  $U_3O_8$  in the coming 10 years. At the same time, over 70% of the expected reactor demands are not contractually secured un-

til 2025. For a little traded commodity like uranium this return to more “normal” long term contracts could put tremendous pressure on the long-term prices as well as on the spot prices. The international plant operators are showing more and more buying signals which are encouraging.

## Conclusion

Fact is that currently 449 reactors are in operation and an additional 300 reactors will be added until 2030. 56 plants are already under construction and 150 additional plants are in the concrete planning phase. Even if half of the old reactors should be shut down until then 600 to 700 reactors would be in operation in 2030.

Furthermore, 90% of the long-term delivery contracts between the uranium producers and the energy generating companies are expiring by the end of 2020 which could get the established nuclear energy nations like the USA into trouble especially.

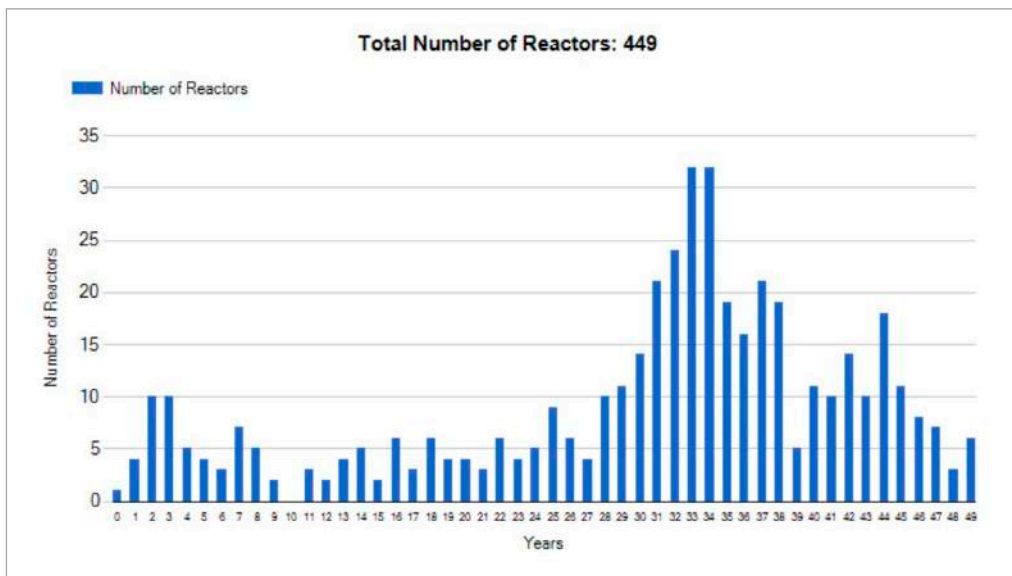
## The Supply Situation

### The established producers are running out of air

The established uranium producing nations Australia, Canada, Russia and Niger have problems to expand their production further. All four countries produced in total just 26.835 tons uranium in 2016. In 2009, they produced 28.000 tons uranium. Australia has problems with BHP Billiton’s Olympic Dam Mine, the by far most profitable uranium mine in this country. In Canada, the production start in Cameco’s MacArthur River Mine had to be postponed many times due to repeated groundwater ingresses. In Niger planned mine openings also had to be postponed.

### The uranium production in the USA has hit rock bottom

The situation in the USA is even worse. Although the Obama government has approved a US\$ 54 billion program for the funding of the nuclear energy indust-



Overview, age of currently operating reactors. Many will be (have to be) replaced by more powerful ones.

(Source: [www.iaea.org/PRIS](http://www.iaea.org/PRIS))



Uranium Energy's Hobson plant is ready for the re-start.  
(Source: Uranium Energy)

ry, it is not clear from where the necessary uranium will be derived. The uranium industry in the USA is only a shadow of the past. During the past 40 years there have been no investments in development of new deposits and almost 95% of the needed uranium was derived from the disarmament programs. The US-American nuclear reactors consume 18.000 tons uranium per year. An expansion of the capacities would also be an increase of the needed amount of uranium. The World Nuclear Association (WNA) estimates that 40,000 tons uranium per year will be needed in the USA alone by 2025. Even at the peak of the US-American uranium production during the 1960s and 1970s, such an amount could not have been produced by the mines in the USA. The US-American uranium production reached its previous peak in 1980. During that year 29,000 tons uranium were produced. After the end of the Cold War disarmed nuclear weapons became the most important source for the US-American uranium demand. This resulted in a decline of the American uranium production from 23,400 to currently 1,125 tons uranium per year. As a direct

result, the majority of the infrastructure and the permitted production facilities were closed or completely dismantled. Currently there are only a few mines in Texas, Arizona and Wyoming.

### **Kazakhstan – the new uranium superpower**

Almost all established uranium producers are having difficulties with the rebuilding or the expansion of their uranium production, but one region has climbed to the top of the uranium production: Central Asia. Kazakhstan especially could multiply its uranium production during the past 10 years. The uranium production of the previous Soviet Republic increased from 2000 to 2016 from 1,870 to over 24,500 tons. Kazakhstan surpassed the previous leader Canada in 2009 and is responsible for close to 40% of the global uranium production.

### **Massive production cuts were already initiated**

Kazakhstan is part of the nations which can mine uranium at the lowest costs. The country is however not willing to give away its uranium resources to absolute low prices anymore. At the beginning of 2017 the state-owned group Kazatomprom announced that the uranium production will be cut by at least 10% in 2017. This would take around 2,500 tons uranium off the market.

But Kazatomprom is not the only uranium producer which opts for production cuts in light of the ridiculous uranium price. The uranium-major Cameco also announced production cuts. These are specifically 4 million pounds of  $U_3O_8$  for the Rabbit Lake Mine and 2 million pounds of  $U_3O_8$  for the MacArthur River Mine which rank among the 10 largest uranium mines globally. From the Husab

Mine in Niger 5 million pounds of  $U_3O_8$  per year are missing and from the Langer Heinrich Mine in Namibia 1.5 million pounds of  $U_3O_8$ .

## Supply gap unavoidable

In spite of the massive production expansion in Kazakhstan during the past years a large supply gap will form in the uranium sector in the foreseeable future. There is already such a gap. Until now this gap could be closed with material from nuclear waste. But the nuclear industry consumes about 10% more uranium than is currently produced. The 449 nuclear reactors worldwide are consuming around 68,000 tons uranium per year, only approximately 62,000 tons are covered by the global uranium production. The International Atomic Energy Agency (IAEA) estimates that the global uranium demand will rise to 140,000 tons uranium by 2030 due to the construction of new nuclear power plants. The percentage of primary supply has to increase because Russia has reached the end of its nuclear disarmament.

## New disarmament contracts without effect to the uranium market

The currently existing disarmament contract between the USA and Russia, New START, will not change that. It provides for a further reduction of the nuclear weapons arsenal by 30%. These 30% don't include the total weapons arsenal at the end of the Cold War but only from 2011. Since 1990 85% of all nuclear weapons have been disarmed. The remaining 15% will be reduced by 30% meaning that from the original amount only 5% will be disarmed.

According to this new contract only 5% of the original amount will be disarmed

during the coming 10 years, while 85% of the original amount was disarmed in the past 20 years. This material has been already consumed in form of fuel elements. The future disarmament uranium is minimal compared to the amount of the past 20 years and will have no big effect on the uranium market. The secondary supply for the uranium market will fall from currently 9% to below 5% by 2030. Therefore, the whole amount of Russia's secondary supply will remain in Russia because Russia has not offer uranium from its own disarmed nuclear weapons at the free market since 2013.

## Summary

The supply side in the uranium sector is going through a transition phase. The secondary supply from Russia's disarmed nuclear weapons becomes less and less important. While in 2006 37% of the demand was covered by disarmed nuclear weapons, currently it is only 9%. Concurrently the number of nuclear reactors will increase rapidly. This rapidly increase in demand will not be completely covered by the established uranium producers – at least not at the current uranium spot price of US\$ 21 per pound  $U_3O_8$ . From where will the needed uranium in the future come from?

An increased production can only be achieved with a higher uranium price and associated large investments in the expansion of existing and the construction of new mines. The basic problem is still the relatively low uranium spot price, which doesn't allow producers to mine difficultly accessible and more expensive deposits.

Experts estimate that there are less than 650,000 tons of economically recoverable uranium at a market price of US\$ 40 per pound uranium.



At an annual consumption of around 68,000 tons uranium, these resources would not even last for 10 years assuming a constant market price of US\$ 40 as well as a constant demand. This will rise inevitably.

If the market price for uranium would increase and would justify production costs of US\$ 80 per pound uranium the triple amount of 2.12 million tons uranium could be mined economically.

At a uranium price of US\$ 130 per pound approximately 5.7 million tons uranium could be mined economically. At the current consumption, the known reserves would last for 83 years.

## Conclusion

### **Doubling of demand is not faced by any expansion of the supply!**

The uranium spot price is as far from the US\$ 130 per pound uranium as the current demand will be from future demand. According to a conservative estimate of the International Atomic Energy Agency (IAEA) this will double during the coming years. The aforementioned range can be cut in half in 10 to 15 years.

It shows that the still – apparently cheap way of generating electricity can only be used if the market price for the starting product uranium increases again. Supply and demand determine the market price for uranium too.

If the market price doesn't allow an economical production, it will have to increase. In the case of uranium, the demand will increase sharply due to the construction of several hundred new nuclear reactors so that the market price will benefit twofold as well as the investor who has recognized that trend in time.

### **High demand is uncovered to date**

As expected the unmet demand will be just less than one billion pounds of  $U_3O_8$  in the coming 10 years. At the same time, over 70% of the expected reactor needs are not contractually secured until 2025. For a little traded commodity like uranium this return to more "normal" long term contracts could put tremendous pressure on the long-term prices as well as on the spot prices. The international plant operators are showing buying signals more and more.

### **The best uranium stocks promise multiplication potential!**

We have taken the current situation of way to low and not reality reflecting uranium spot price plus the expected future supply deficit to present you a compact summary of promising uranium stocks. Our focus is especially on development companies with very promising projects because these offer, besides the actual appreciation due to a higher uranium spot price, in this connection also a high takeover chance. At the end of 2015 the merger (in fact a takeover) of Fission Uranium with (by) Denison Mines failed due to, among other things, the vote of Fission's shareholders. This example shows that the investor can act on the assumption that there will be other takeover or merger possibilities in the future. That is because the uranium sector is currently undervalued and has to be rectified first.

# Interview with Dr. Christian Schärer – Manager of the Uranium Resources Fund and partner of Incrementum AG

**Dr. Schärer you are manager of the Uranium Resources Fund of LLB Fund-services AG in Liechtenstein (ISIN LI0122468528). What is your strategy and what precisely represents the Fund?**

The Fund invests heavily in companies which are involved in the development and mining of uranium deposits. The Fund predominantly has shares of mining companies in its portfolio. Thereby we limit ourselves to the first part of the uranium value chain. The investment goal is to get a maximum benefit of the emerging supply gap in the uranium market. This supply gap is the result of a scissor movement of supply and demand at the uranium market. While supply has been stagnant for years due to falling uranium prices, the demand is continuously growing with high visibility of 3% per year. Until now the supply deficit is covered by existing inventories as well as secondary sources. But this will not be sufficient in the near future...

**Nuclear energy, especially in the German-speaking region, is controversial and the politics has initiated the exit out of nuclear energy. Nevertheless, you are confident that the uranium market will form a bottom from a cyclical perspective. You assume an increase in demand by 3% per year. What makes you so confident?**

We have to differentiate between the situation in Germany or in Switzerland on one side and the global perspectives on the other side. Contrary to Germany, the emerging economies in Eastern Europe or Asia count on the expansion of nuclear energy. By February 1st, 2018 448 reactors were online globally. This is a historical record. Furthermore, according to the International Atomic Energy Agency

(IAEA) 60 reactors are under construction worldwide, more than half of them in China (20), Russia (8) and India (5).

The construction of new nuclear power plants should reduce CO<sub>2</sub> emissions and air pollution as well as the dependence on imports of fossil fuels. In addition, nuclear energy provides the baseload to the power grids which are constantly under pressure due to the fast-growing demand. Despite the events in Fukushima and the nuclear phase-out in German-speaking regions, this results to a capacity expansion of the nuclear energy production from 330 gigawatts (2016) to 580 gigawatts in 2030 in total. The predicted demand growth of around 3% per year is to be seen against this background.

**Since 2011 the uranium price is permanently under pressure. What are the main reasons for this price collapse and how do you assess the current market situation?**

The uranium price is moving in multi-year cycles. The price movement between the lower and upper turning point is enormous. During the bull market of the 1970s the uranium price increased from US\$3 to US\$43 to drop by 70% to US\$8 by 2001. During the next cycle the price climbed to US\$130 by 2007. Of course, enormous profit opportunities as well as significant risks are associated with such price fluctuations.

Since the reactor accident in Fukushima in 2011, the price dropped from US\$ 75 per pound to currently US\$ 21 at the uranium spot market; a movement that puts tremendous pressure on the producers. Three reasons seem to be primarily responsible; first, the sale of uranium from the inventory of the Japanese nuclear power plant operators that were dis-



Dr. Christian Schärer is a partner in Incrementum AG and responsible for special mandates.

During the course of his study he was looking for strategic success factors of successful business models. A topic that fascinates him until today and inspires him when selecting promising investment opportunities. Dr. Schärer studied business administration at the Universität Zürich and he received his PhD extra-occupational at the Bankeninstitut Zürich for an analytical survey of the investment strategy of Swiss pension funds in the real estate sector. Since 1991 he has gained comprehensive financial market knowledge in several roles as investment adviser, broker and portfolio manager. Since summer 2004 Dr. Schärer's focus as an entrepreneur, adviser and portfolio manager is on several investment themes with material asset character. He brings his practice-oriented financial market knowledge as board member to companies.



connected from the power grid after the reactor catastrophe in Fukushima. Second, the sale by uranium producers with liquidity shortages and producers with uranium as a by-product, which then sell the uranium with little price sensitivity. Third, the restraint of the buyers which are not stressed by falling prices despite low inventories.

At that reached price level we see the uranium market now at an interesting milestone. The bear market seems to be over. Since one year the uranium price tries to form a bottom. Besides the mentioned good demand, we see a reduced supply and an increasing price discipline on sides of the producers as possible catalysts for a considerable recovery of the uranium prices.

***You mentioned that the low uranium prices are putting massive pressure on the producers. How do the uranium producers come to terms with these low uranium prices and why do you expect a rebound?***

The low price of uranium at the market is a tremendous challenge for producers. A profitable production is unthinkable in this environment. The costs are reduced accordingly consistently. Production plans are adjusted to the low prices and unprofitable mines are closed. The existing capital is allocated with much discipline. Development and expansion projects are rescaled or cancelled accordingly. It is noteworthy that some producers have started to buy uranium at the spot market to meet the long-term commitments entered into. The current spot price is obviously below their production costs! These actions have the advantage that the as yet not produced uranium stays in the ground and can be sold for higher prices at the market. With this behavior the producers are tight-

ening their supply and are preparing the ground for a medium-term price turnaround at the uranium market when the stagnant supply cannot satisfy the steady demand from China and India against this background. In other words: at the uranium market a growing supply gap is forming in the foreseeable future which will be closed by rising uranium prices. We assume that the uranium prices will have to recover in direction US\$ 70 permanently to stimulate the necessary expansion of the production capacities...

Returning to your question; we expect the change for the better to materialize during the current year. During that time-frame an inventory cycle comes to an end for many European and American nuclear power plant operators. They will have to come to the market to rebuild their inventories. From today's perspective around 40% of the demand for 2020 is not contractually secured. This impulse could become the catalyst of a sustainable turnaround. In addition, the spot market does not have the liquidity like in the past two years because the two largest uranium producers (Kazatomprom and Cameco) have announced a significant reduction of their production during the current year. Normally the market will anticipate this turnaround within a time-frame of several months...

***Is such a fund, focused on a single commodity, not too specialized and therefore too risky?***

An investment in the fund is a focused bet on the emerging supply gap at the uranium market. An attractive return potential is opening up in front of an investor with a medium-term investment horizon which could also be very risky. Therefore, the fund is suitable as complementary building block in a diversified portfolio but not as a basic invest-



ment. The Uranium Resources Fund has between 25 and 30 positions in the portfolio. This diversification makes sense against the background of the current state of the uranium market.

***What do you recommend to investors who are interested in an investment in the uranium sector?***

The outlined supply gap and the related potential of rising uranium prices are only foreseeable at the moment. The exact timing of the expected turnaround at the uranium market is uncertain despite the good perspectives. If, against expectations, the current phase of bottom building continues for a longer time the air will become thin very fast for some uranium producers. Their balance sheets are emaciated after the persistent price collapse and the cost reduction potentials are mostly exhausted. Even for a developer of new uranium projects the environment is challenging because their projects become economically viable and thereby feasible with increasing uranium prices. As a result, it is difficult to find investors for the funding of the next project stages. Who bets everything on one card at that constellation takes a big risk – possibly too big. The stake within a diversified investment fund seems to be reasonable. In addition, we suggest a timely scaled build-up of the positions.

***What are your selection criteria for the selection of your fund holdings?***

We initiated the fund with confidence based on the described positive medium-term prospects three weeks before the reactor accident in Fukushima. These events have pushed back the positive starting position by 5 to 6 years. The decommissioning of the Japanese reactor fleet, which comprises 10% of all opera-

ting reactors worldwide and the related uncertainty about the future perspectives of the civil use of nuclear energy is responsible for that. Against this background we became very humble although we still feel confident about the potential of the uranium market. Our primary goal is to remain a player when the uranium market rebounds.

Our portfolio is therefore based on three pillars. The core of the portfolio is comprised of 2 solid basic investments. First an investment in Uranium Participation (U CN), a Canadian holding company which invests in physical uranium. If we are right the supply gap at the uranium market will be closed by the increasing uranium price. Uranium Participation will be one of the first and direct profiteers. In addition, we always have a significant position in the Canadian industry leader Cameco (CCO CN). The company has a broad-based portfolio of World Class Assets, is cash flow positive and pays a dividend despite the challenging environment.

When the prices begin to climb only the producers, which can place a significant uranium production on the market will benefit. Only the one who produces can deliver. To be on the safe side we invest in companies with low production costs and that have a solid order book. It is good to know in this context that only a relatively small amount of the annual uranium production is traded at the spot market. The main portion of the uranium production is processed within long-term delivery contracts at a predetermined (forward) price. We invest in companies that have sold a significant portion of their production in the past at a predetermined price, which is considerably higher than the current spot prices. This softens the current psychological strain. As examples for companies in this category can be mentioned Ur-Energy (URE CN) or Energy Fuels (EFR CN).



Third, we invest in explorers and developers that are advancing development and mining projects on a world class level. Of special interest are those that can start their production in the timeframe of the expected supply gap. They will benefit from the attractive sales prices. In addition, these assets should have the necessary size to qualify as take-over targets. We assume that after the price turnaround at the uranium market a consolidation wave will roll through and mining companies from outside the sector would like to position themselves in the uranium business as well. This would make sense due to the low cyclical sensitivity and the relative high visibility of the uranium production.

***Currently which are your biggest individual positions and why?***

Besides the mentioned standard assets Uranium Participation and Cameco assets like Uranium Energy (UEC US), Berkeley Energia (BKY LN), NexGen Energy (NXE CN), Energy Fuels (EFR CN), Fission Uranium (FCU CN) or Denison Mines (DML CN) fit, for various reasons, in our aforementioned acquisition strategy.

***In addition, do you keep an eye on smaller uranium companies which could become interesting during the coming months?***

This is a difficult question. A consequence of the bear market is the disappearance of many companies. At the height of the last bull market around 500 companies with focus of uranium were listed. Today only 40 to 50 companies with reference to uranium are suitable investments. However, there are some attractive investment possibilities. If I have to name one of my favorites it would be Berkeley Energia , which is the largest

position in our fund today. The company has started the construction of the Salamanca uranium mine in Spain and will commence production in 2019, latest. At that time many nuclear reactor operators in the EU might start to renew their long-term delivery contracts. Berkeley Energia is in an excellent position because the Salamanca mine will be the only significant uranium producer in the EU-region. This makes the project attractive from a strategic point of view. In addition, I like that, by global comparison, low investment volume of less than EUR 100 million is necessary to bring the mine to production. This is the result of the excellent infrastructure (water, electricity, and workforce) and the attractive geographic location. Due to the fact that the uranium deposit is near the surface low cost open pit mining is possible. A comparable low investment volume, low production costs and an annual production volume of around 4.4 million pounds make this project very attractive from an economic point of view.

In addition, the state fund from Oman took a long term holding in “Berkeley Energia” with the investment of around US\$120 million within a convertible bond last year. Thereby the construction of the mine is financially secured. If we assume the conversion of the bond into shares of the company later Oman will be, with a holding around 37%, a strategic major shareholder. A clear commitment to the long term intact perspectives of the uranium market!

# Interview with Scott Melbye

## Executive Vice President of Uranium Energy, Commercial V.P. of Uranium Participation Corp. and Advisor to the CEO of Kazatomprom

*Mr. Melbye, over the course of your career you have held positions as Executive Vice President, Marketing of Uranium One, President of Cameco Inc., Chair of the Board of Governors of the World Nuclear Fuel Market and President of the Uranium Producers of America. Currently, you are serving as Executive Vice President of Uranium Energy, Commercial V.P. of Uranium Participation Corp., and as the Advisor to the CEO of Kazatomprom. In other words: You are THE uranium expert! What led to your uranium-career?*

Thank you, that is very nice of you to say. I feel fortunate to have spent my entire career in the uranium and nuclear energy business. Our industry is quite unique in that it is a fairly small and international community of quality, smart, and devoted people who are all pulling together to supply 11 percent of global electricity supplies with highly reliable, clean-air, base-load energy.

My introduction to the uranium business was at a very young age. Being a second-generation uranium miner, I grew up around the business. My father, Chuck Melbye, graduated from the Colorado School of Mines in 1950. He explored, and developed uranium deposits throughout the Colorado Plateau, Wyoming and even Paraguay, with joint venture partners such as Southern California Edison, Korea Electric Power and Taiwan Power Company. I recall an early memory at the age of 12 travelling to Moab, Utah with my father to meet a bearded and dusty old prospector at the local motel coffee shop. After spreading out the exploration maps over the breakfast table, we jumped in his old pickup truck and headed out a jeep trail into the remote red-rock canyons and plateaus of that prolific uranium district. Arriving at the prospective outcropping, we took some scintillometer readings, bagged some mineral samples (kicking a scorpion off

one of them) and headed three hours back into town. Experiences like this helped me develop a real passion for the resource business. Years later, I graduated from Arizona State University in 1984, and took on my first industry role with uranium broker, Nukem Inc. in New York.

*Since mid-2015 we saw significant volatility in the uranium spot-price. It went from 40 to 18 and back to 26 US\$. So, have we already seen the bottom?*

The short answer is yes, even though we will have some starts and stops before we fully gain traction (as has been the case recently with the price back down around the US\$21-\$22 level). The industry has been in a seven-year bear market that began after Fukushima in March 2011. This has been a long and challenging downturn, as it would be for any commodity. While this period has challenged the patience of uranium investors, the depth and breadth of this downturn has sowed the seeds of an even more robust and sustainable recovery. We are finally seeing years of low prices beginning to take its toll on the supply side of the market. Production cutbacks are becoming the norm (and accelerating), as higher priced legacy term contracts begin to fall off. Uranium prices in the low US\$20's per pound  $U_3O_8$  range are simply unsustainable over the longer term. All-in production costs of the lowest cost mines are higher than the current depressed price level. Further, the current price environment fails to incentivize the majority of undeveloped uranium projects towards construction.

*Japan is going to bring its reactors back to the grid step-by-step, but cancelled a supply-contract with Cameco in early 2017. Will Japan put too much pressure on the spot-price?*



Scott Melbye is a 34-year veteran of the nuclear energy industry having held leadership positions in major uranium mining companies as well as industry-wide organizations. Through to June 2014, Melbye was Executive Vice President, Marketing, for Uranium One, responsible for global uranium sales activities. Prior to this, Melbye spent 22 years with the Cameco Group of companies, both in the Saskatoon head office and with their U.S. subsidiaries. He had last served as President of Cameco Inc., the subsidiary responsible for marketing and trading activities with annual sales exceeding 30 million pounds  $U_3O_8$ . Melbye was formerly the Chair of the Board of Governors of the World Nuclear Fuel Market and President of the Uranium Producers of America. He also currently serves as Executive Vice President of Uranium Energy and VP-Commercial for Uranium Participation Corporation and just completed a two-year term as an advisor to the CEO of Kazatomprom, the world's largest uranium producer in Kazakhstan. He also sits on the advisory board of the Colorado School of Mines, Nuclear Engineering program. Melbye received a Bachelor of Science in Business Administration with specialization in International Business from Arizona State University in 1984.

The pace of the Japanese recovery has certainly been a disappointment. Most analysts, including me, have been wrong as to how quickly their reactor restarts would occur. The good news is that positive developments took hold during 2017 (despite Cameco's high-profile contract dispute with Tokyo Electric Power, which appears to be isolated to those parties). Japan now has 21 reactors in the restart process with Federal regulators, with fifteen Safety Review approvals being handed down by the NRA. We are expecting to see a total of nine reactors restarted and operating in 2018 (five are currently in operation today). These don't sound like big numbers, but should be viewed as positive developments for both market fundamentals and sentiment in the uranium industry. Furthermore, recent Energy Policy has reaffirmed a target of having nuclear provide at least 20% of Japanese energy supplies going forward. This policy was further strengthened with the landslide reelection victory of pro-business and pro-nuclear Prime Minister Shinzo Abe. While this issue remains very emotional with many Japanese, the replacement cost of fossil-fueled electricity has raised household power bills by close to 14% in just 4 years. Japan has few viable alternatives going forward and nuclear provides protection against both supply and price risk from fossil fuel imports (much of which is produced in the Middle East).

***In the last few months, a couple of producers reported that they are planning to cut their production, including Kazatomprom where you served as an advisor for the past two years. Will this significantly affect the uranium spot-price?***

This is absolutely a key catalyst in the uranium price recovery that has been long in coming. Global uranium producti-

on amounted to 162 million pounds in 2016. While this continued a trend of annual uranium production increases in the face of low prices, the rate of increase has finally reversed as cutbacks are being implemented. Global production in 2017 fell to 151 million pounds and could decline further to below 140 million pounds in 2018. This supports observations that a peaking of mine production has finally occurred. Several high-profile production cutbacks have been announced, including Cameco's Saskatchewan and U.S. operations, Areva's Niger mines, Paladin's Namibian Langer Heinrich mine and Kazakhstan's ongoing reductions in output. The announcement by Cameco to shut in their world-class MacArthur River Mine in late 2017 has been particularly significant. The MacArthur River Mine (and associated Key Lake mill) in Northern Saskatchewan represents the world's richest uranium deposit, with ore grades 100 times the global average and is the world's largest in terms of annual output. Cameco has declared that this operation will be down for "at least 10 months", which would equate to as much as 18 million lbs of global, tier-one, production being removed from the supply mix. As Cameco continues to sustain global sales at a level exceeding 30 million pounds per year, this bold move will serve to drawdown inventories much faster than envisioned even one year ago and put Cameco into the market as a significant buyer of uranium. Subsequent to Cameco's announcement, the Kazakh state producer, Kazatomprom, followed up their 10% cut in 2017 production, with an announced 20% reduction in planned output over the years 2018 to 2020. While analysts are still struggling to define the exact volumes impacted, it is definitely a continued strong signal that the world's largest producer of uranium, accounting for about 40% of global mine supplies, is intent on pursuing a rational and discipl-

lined market approach going forward. The planned 2018 IPO to privatize a 25% share of the company will also incentivize Kazatomprom to do anything in their power to support global uranium prices during, and after, this process.

Finally, while not a production cutback, we received great news in early 2017 that the U.S. Department of Energy ("DOE") has bowed to pressure from the U.S. producers and reduced the amount of government inventories that are released to the market by over 1 million pounds per year in 2017 and 2018. This may not sound like much, but combined with announced production cutbacks, close to 50 million pounds of current/future supply has now been removed from the market over the past 24 months. It should also be recognized that an additional 17 million pounds per year will be removed by 2025 from the expected resource depletion of currently operating mines.

***Many long-term contracts will run out in the next 12 to 18 months. Utilities are beginning to return to the market. Will they get their uranium for less than 30 US\$ per pound?***

Only in the very near term and until such time renewed utility uranium procurement levels pick back up. This is the other key catalyst that has me excited right now, but has yet to fully hit the market.

The world's fleet of operating reactors, and those nearing completion, are now expected to generate a cumulative fuel requirement of 174 million pounds of  $U_3O_8$  in 2018. This fuel requirement is expected to grow to 196 million pounds by 2030. While this demand for uranium is fairly steady and predictable, the procurement decisions of utilities can vary based on contract coverage, inventories, forecasts of future prices and risk tolerance. The previous contracting cycle,



Uranium production in Kazakhstan

(Source: Kazatomprom)

brought on by uranium price spikes in 2007 and 2010, resulted in utilities rushing to contract at higher prices and for very long terms. While these old contracts are expiring, the utilities have not been moving to replace these supplies. As a result, the forward coverage of utilities has fallen appreciably, increasing the uncommitted requirements that will need future contract coverage. These unfilled needs (under recently revised conservative estimates) currently total around 742 million pounds over the next 10 years, which is higher than the 705 million pounds of uncommitted demand existing in 2011. In a thinly traded commodity, like uranium, this return to more normal long term contracting levels should put considerable upward pressure on long term and spot prices. We are beginning to see the signs of this increased buying activity by global utilities which is very encouraging. However, utilities in the United States are continuing to sit on the sidelines in a wait and see mode as to the direction future fundamentals. Perhaps a catalyst behind this perceived complacency, stems from the Section 232 Trade case which was filed by two U.S. producers with the Department of



Commerce early this year. A “232” filing is made to address harmful levels of foreign imports reaching a point which endangers national security. Today, less than 5% of domestic needs are fulfilled by domestic mines, despite abundant resources and competitive potential. As the proposed remedy of this filing is a reserved 25% quota of U.S. reactor requirements for U.S. domestically mined uranium, there is a great deal of uncertainty in the market until the Trump Administration rules in this “buy American” issue. Similar trade actions have been filed with regards to aluminum and steel imports, so market observers are keeping a keen eye on this development.

***New reactors are being built and older ones will be shut down. What does this mean for the future demand? Do new reactors need more uranium than older ones?***

Ten reactors were added to the global grid during the 2016 calendar year, exceeding the mark set in 2015 for the highest growth rate of nuclear power capacities in the past 25 years. While 2017 reactor additions were down from 2016, the pause is only temporary, as there are currently, 57 nuclear reactors under construction in 14 countries with the principal drivers of this expansion being China, Russia, India, South Korea, and the United Arab Emirates.

The World Nuclear Association reports that 448 reactors are operable in 30 countries. These reactors have a capacity of 393 gigawatts of electricity and supply about 11 percent of the world’s electrical requirements.

The new reactors are all of designs which exceed 1000 megawatts and more than compensate for the retirement of some older smaller reactors that have reached the end of their operating lives. The total demand for uranium will increase with the requirements of the larger reactors balanced against the retirement of the ol-

der smaller units with designs typically less than 1,000 MWe.

A trend to keep our eyes on, and not yet factored into the near-term supply and demand analysis, is the growing emergence of Small Modular Reactor (“SMR”) designs. These are reactor designs which have a 50-300-megawatt range of output, and are similar to the small, compact U.S. naval reactors which have operated safely since the 1950’s. SMR’s can be mass produced in factories and shipped on site. They are scalable in nature, can accommodate small grids like islands and remote areas, require much lower upfront capital, and have a faster pay-back period due to short construction times. The U.S. Nuclear Regulatory Commission is updating their regulations to accommodate these small-scale power producers, which has been a big barrier to entry to date. While these reactors will use less uranium than today’s large units, this potential new growth area is a very welcome development.

***Just to give the readers some numbers: How much uranium does a new reactor need for the first load and how much does it need for further loads?***

Great question and something that adds to near term uranium requirements due to the 57 reactors currently under construction. A reactor under steady-state operation refuels only once every 12 – 24 months depending on their optimal fuel management and operating strategy. At these periodic refueling outages, approximately one-third of the reactor core is replaced with fresh fuel and the remaining fuel assemblies are shuffled to new locations in the core. The oldest fuel that has been in the reactor for several years is retired to spent fuel storage for ultimate disposal (or is reprocessed into new fuel).

In the case of a new reactor in its first operating cycle, the entire reactor core needs to be loaded with fresh fuel. This



*There is extremely high air pollution  
in the Chinese cities.  
(pixabay/ 3dman\_eu)*

creates what is known as the “initial core effect”. The first core fueling requires about 1.5 times the uranium required in a typical reload (the reason it is not 3 times more has to do with lower U-235 enrichment levels in the first cycle). Taken collectively across all of the new reactor start-ups, the bump in global requirements is substantial, not to mention that these requirements tend to be procured earlier than subsequent reloads.

To put this into actual numbers, a new Westinghouse AP-1000 reactor (like those being built in Georgia) require about 1.65 million pounds for an initial core, with a reload requiring around 1.1 million pounds. This can, of course, vary based on operating cycle-length and tails assay (depending on the relative prices of uranium and enrichment).

***The new leading nuclear nation will be China. How will their current construction plans effect the uranium sector?***

China continues to lead the global nuclear growth story, expanding from their currently installed 35 gigawatts of capacity from 38 reactors, to close to 150 gi-

gawatts by 2030. The Chinese government has increased its emphasis on nuclear energy as a way to deliver vast amounts of electricity, without adding to the severe air pollution crisis from carbon emissions affecting their major cities. In terms of reactor requirements Chinese annual uranium consumption will rise from 20 million lbs in 2017, to over 75 million pounds by 2030.

This all has a profound impact on global uranium supplies, as China possesses relatively little in the way of quality domestic geologic uranium reserves, despite its large geography. As such, China state-owned companies have been aggressively pursuing uranium imports to the tune of about 50 million pounds of  $U_3O_8$  per year, taking advantage of the uranium downturn and accumulating an under-valued commodity that they will rapidly consume at their current growth rate. Their investments in foreign uranium deposits and production assets also have significant impacts on the global market. While their massive investment in the Husab uranium mine in Namibia will advance this mine’s development earlier than economics would otherwise dictate, other investments in existing mi-

nes, like Langer Heinrich, also in Namibia, will take significant volumes of production “out of circulation” for western utilities.

***Much has been said lately about the nuclear energy program of the United States, currently the world’s largest fleet. So-called de-regulated electricity markets and low natural gas prices have put some plants under economic stress. What is the Trump Administration doing to address the continued viability of nuclear energy in the U.S.?***

We have actually seen a great deal of positive developments on this front in the past year, and the Trump Administration has certainly been supportive of both the nuclear energy industry, and uranium fuel cycle, in the United States. The challenge is not that nuclear reactors are uncompetitive with their low US\$0.03 to \$0.05 per kilowatt hour generating cost. The market structure in these supposedly de-regulated jurisdictions are severely distorted by the high levels of subsidies granted renewables and compounded by low natural gas prices. Unfortunately, renewables provide the lowest level of as-needed reliability, and gas prices cannot be relied upon to stay low forever (or simply through the cold winter weather months). Meanwhile, the potential loss of 24/7 reliable and carbon-free base load electricity from nuclear is put in jeopardy. The Trump Administration has certainly taken on this energy security predicament as a priority, emphasizing the need for a reliable and robust electric grid under all supply and demand scenarios. While the DOE directives in this regard did not result in mandated changes through Federal Energy Regulatory Commission (“FERC”) regulatory measures in 2017, the onus is now on the individual states to demonstrate the price stability and reliability standards recommended

by DOE. Already New York, Connecticut and Illinois, have taken real concrete steps to reform these market dysfunctions and preserve this critically important base load nuclear power in the name of reliability and grid stability. Other states like Ohio, New Jersey and Pennsylvania are considering similar legislation. The performance of U.S. nuclear power plants during recent “polar vortex” winters, and hurricanes, have only reinforced the need for this policy shift by the Trump Administration and individual states.

Elsewhere in the regulated markets of the Southeastern United States, we are seeing the construction of two new reactors of the Westinghouse AP-1000 design. Two additional units in South Carolina had begun construction, but are on hold for the time being. Unfortunately, these massive construction projects were caught up in the bankruptcy restructuring of Westinghouse given their inability to effectively manage these construction programs. The good news is that the Vogtle units 3&4 in Georgia will proceed to completion under a new construction manager, Bechtel, and will be supported by extended loan guarantees from the Trump Administration. The Summer units 2&3 in South Carolina remain in suspension, but here too, the story can still turn positive with state officials and potential investors looking at ways to complete these reactors and bring them into operation.

While some isolated, older operating units will succumb to decommissioning in the United States in the coming years, like that of Oyster Creek recently in New Jersey (1969 start-up), we are seeing the opposite occur with most U.S. reactors pursuing (and receiving) approvals for license extensions to add 20 to 40 years of additional operating years to their safe and useful lives. Already, Exelon, Dominion and NextEra Energy have said they plan to ask regulators to extend 60-year licenses by 20 years for eight reactors in

Virginia, Pennsylvania and Florida. Requests for as many as 20 more are expected to follow. Also last year, the Palisades nuclear power plant in Michigan, that was slated to be retired in 2018, is now pursuing a plan to extend operations for four additional years. The value of these vital base-load electricity generators, from both an economic and energy security perspective, are perhaps finally becoming more widely recognized.

***Let's come to uranium supply. Do you see major new mines starting production in the next five to eight years? What does the pipeline look like and what price will most companies need to advance development, and bring their projects into production?***

This development should be startling to the nuclear generating companies, and probably explains the current, and very strategic appetite for Chinese investment. Beyond the large Chinese Husab mine, we see very little in terms of new mine development. From a producer's viewpoint this is not surprising, given the seven-year period of challenging price conditions we have experienced. The incentive price for meaningful new uranium production (new developments or mine expansions) to come to the market is estimated by BMO, in their March 2017 uranium market outlook, to be higher than US\$60 per pound  $U_3O_8$ . This, and the prolonged licensing and permitting process required to bring on new production (as much as 10 years or more for a major conventional mine/mill complex), make for an interesting situation as the uranium market is expected to move into a near term supply deficit amidst higher contracting volumes.

***In summary: What are your feelings about the current supply-demand-sta-***

***tus in the uranium sector and could this lead to another uranium-price upward trend?***

The uranium market has required a great deal of patience from investors as it has worked through the over-supply conditions that emerged out of the Fukushima events in 2011. Having said that, as we head into 2018, we have a very exciting development materializing that is rarely seen, but certainly coveted, by commodity investors. With the record number of reactors operating, and coming on-line around the world, we are seeing a robust and growing global demand for uranium. While utilities have recently been heavily covered under contract from past cycles, we see a new contracting cycle emerging that will put renewed stress on available supplies in the coming years. The trend of global uranium production cutbacks, like those announced by Canada and Kazakhstan late last year, have been long in coming. These cutbacks will likely continue at a time when the pipeline for new supplies is at a low point, and lead-times required to reverse that trend could be rather prolonged. The price impact could be acute.

This is certainly the right time to be positioned in uranium investments to capitalize on an emerging, sustained, price recovery.

# Blue Sky Uranium

## High-grade uranium projects with good prospect of low cost open pit mining!

The majority of standard uranium mines produce the uranium ore by underground mining techniques raising the construction and mining costs. The Canadian development company Blue Sky Uranium owns several huge uranium licenses in Argentina which, after initial inspection of the drill results, can probably be mined by open pit methods. This is an enormous cost advantage which promises not only faster mining but also high margins.

### **Amarillo Grande Uranium-Vanadium Project: Location, Resources and Mining Possibilities**

Blue Sky Uranium's flagship project is Amarillo Grande which consists of three subprojects: Anit, Ivana and Santa Bar-

bara. In 2010 Blue Sky Uranium received the exclusive right to complete airborne geophysical surveys over an area of 2.265 million hectares. After a detailed study the company decided to acquire the mining rights for Anit, Ivana and Santa Barbara because several significant anomalies were discovered on these projects. The three license areas cover an area of 269.000 hectares in total and are located in the province of Rio Negro, Argentina. Anit, Ivana and Santa Barbara are situated within a 140km long trend which hosts several known uranium deposits. Besides the near surface uranium mineralization, Amarillo Grande also hosts significant vanadium resources. This is interesting because the price of vanadium has more than doubled since the fall of 2016 and vanadium as by-product could significantly contribute to a low-cost production. The uranium and vanadium ore occur in depths of 0 to 25m whereby the deposits can extend over several kilometers. The overburden is comprised of only slightly compacted sand which results in favorable mining and extremely low drill costs. Mining will be carried out by a so-called scraper which strips the rock layers and a conveyor loads the stripped material directly on a following truck. No drilling and blasting is necessary, which drastically reduces the mining costs. In addition, the company does not need the majority of excavators usually needed. The ore material could be processed in a central processing plant located between the three subprojects by means of the low-cost leaching process. All these benefits make it possible to mine low grade deposits. An example for such a mine is Langer Heinrich in Namibia where the corresponding resources are mined for less than US\$18 per pound of uranium. It should be noted that Blue Sky Uranium has the advantage of the additional vanadium resources.



*Amarillo Grande is located in the province of Rio Negro, Argentina.  
(Source: Blue Sky Uranium)*

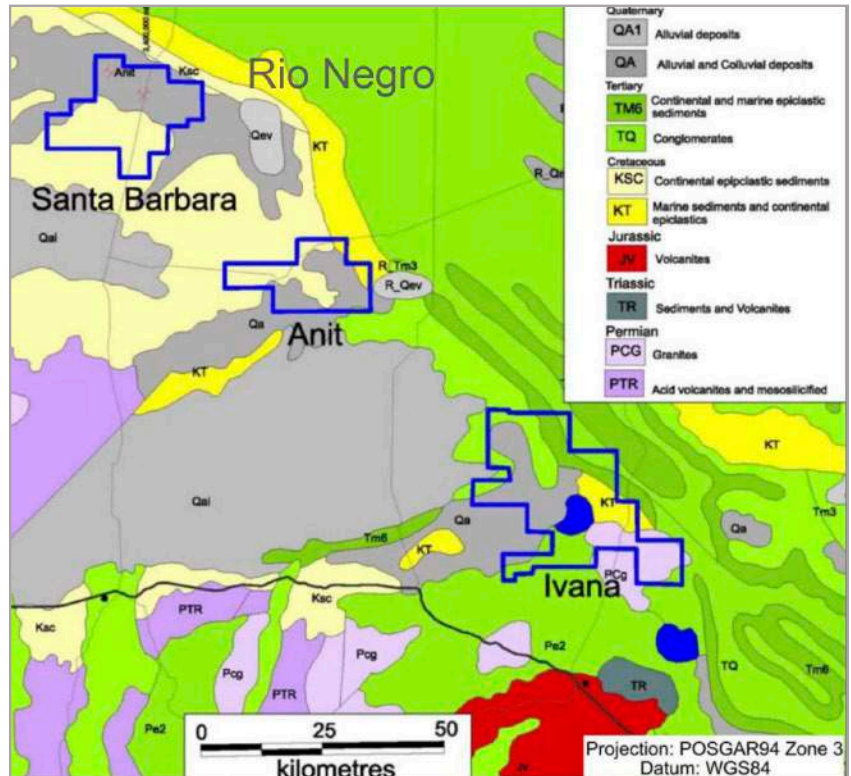
## Amarillo Grande Uranium-Vanadium Project: Ivana

Ivana is the largest and southernmost subproject. It covers 118,000 hectares and hosts a 25km long anomaly. Within a 4,500m x 1,500m corridor a high-grade mineralization was discovered by sampling and drilling corresponding to previous radiometric surveys. Initial sampling provided results of up to 1.81%  $U_3O_8$  over 0.75 m. This sample was collected only 2m below the surface.

Follow-up drilling provided among other things:

- ▶ 3,136ppm  $U_3O_8$  over 1m,
- ▶ 2,182ppm  $U_3O_8$  and 1,285ppm  $V_2O_5$  over 2m,
- ▶ 2,087ppm  $U_3O_8$  and 1,892ppm  $V_2O_5$  over 1m,
- ▶ 1,861ppm  $U_3O_8$  over 3m,
- ▶ 1,473ppm  $U_3O_8$  and 721ppm  $V_2O_5$  over 1m
- ▶ 1,410ppm  $U_3O_8$  over 1m,
- ▶ 1,135ppm  $U_3O_8$  over 5m and
- ▶ 1,130ppm  $U_3O_8$  over 5m
- ▶ within significant Uranium and vanadium mineralization of up to 20m in thickness. All these drill results are from maximum depths of 23m!

In September 2017 and January 2018 re-leased drill results could extend the strong mineralized corridor by 3km to the northeast and suggest that the corridor continues to the north and south. Furthermore, additional drilling provided further high-grade result, among other things, 10,517 ppm  $U_3O_8$  over 1m and 8,618 ppm over 1m within a larger intersection of 8m with more than 2,200 ppm  $U_3O_8$  and 2,800 ppm  $U_3O_8$  respectively. In January 2018 the next spectacular result followed! The company identified, among other things, more than 20,000 ppm  $U_3O_8$  (equals over 2%) over 1m.



That successfully confirmed the initial grades of more than 1%  $U_3O_8$ !

## Amarillo Grande Uranium-Vanadium Project: Anit

The second subproject, Anit, covers around 24,000 hectares and lies between Ivana and Santa Barbara. Anit is located on a 15km long trend showing near surface uranium mineralization. Special attention is on a 1,000m x 200m corridor within a paleo channel.

Historic exploration activities identified for 81 drill holes an average grade of 0.03%  $U_3O_8$  and 0.075%  $V_2O_5$  over 2.6m. In the western and central zones 103 pits were discovered which had uranium grades of more than 50ppm whereby on average 1.97m with 0.04%  $U_3O_8$  and 0.11%  $V_2O_5$  were detected. A drill campaign, which started in May 2017, identified uranium grades of up to 1,114ppm  $U_3O_8$  and up to 3,411ppm

*Blue Sky Uranium's flagship project is Amarillo Grande which consists of three subprojects: Anit, Ivana and Santa Barbara. (Source: Blue Sky Uranium)*

$V_2O_5$ . The very high-grade vanadium resource especially attracted the attention of the management so that additional work and drilling is planned in this area. Blue Sky's management believes that this corridor could be 5km or more long. Test works also showed that the majority of the present uranium and vanadium resources could be significantly improved by wet screening because coarse gravel in particular contains hardly any uranium. This could reduce transport and processing costs and achieve production at several satellite projects concurrently.

### **Amarillo Grande Uranium-Vanadium Project: Santa Barbara**

The third subproject Santa Barbara lies northwest of Anit and is still at a very early stage. Blue Sky Uranium could already identify several anomalies on the project and wants to make a new discovery soon.

### **Amarillo Grande Uranium-Vanadium Project: current activities**

Currently the company is increasingly focusing its activities on Anit and especially on Ivana. Ivana especially is at the focus because the company tries to extend the discovered high-grade areas and provide a resource estimate as quickly as possible. To this end the company works with an electrical tomography program covering 11km and a drill program comprised of 4,500m. Metallurgical test runs are conducted concurrently to establish an optimal leaching process and to receive the highest possible recovery rates. In January 2018 recovery grades for uranium of over 95% were determined. The completion of a resource estimate was commissioned.

### **Exploration projects in Chubut Province**

Blue Sky Uranium has additional exploration projects in the Chubut Province south of Rio Negro.

The Sierra Colorada project covers around 39,900 hectares. The project is located 96km from Cerro Solo project (not Blue Sky Uranium) in a similar geologic environment. The National Commission of Atomic Energy could already confirm a significant resource at Cerro Solo. Sampling at Sierra Colorado could prove up to 0.65%  $U_3O_8$  and 1.55%  $V_2O_5$  as well as traces of molybdenum.

Blue Sky Uranium's second project Tieras Coloradas is situated northeast of Sierra Colorada and to date was explored only sporadically for existing deposits although the company detected near surface mineralization by radiometric surveys.

The Cerro Parva project covers around 67,800 hectares and is located only 40km east of Cerro Solo.

The Chubut projects are intended for a future pipeline expansion and therefore are not currently in the development focus of the company.

### **Grosso Group: the game changer**

Blue Sky Uranium belongs to the Grosso Group. The Grosso Group is a resource management company that is in operation since 1993. The company is specialized on South America and especially on Argentina. During this time, they made three multi million ounces precious metals finds in Argentina. In addition, partnerships could be entered with resource giants like Barrick, Areva, Rio Tinto, Teck and Yamana. Company chief Joe Grosso was awarded Argentina's Mining Man of the Year in 2005. The Grosso Group has a vast network of industry and political

contacts in Argentina. Grosso is director and chairman of Blue Sky Uranium since October 2017.

### **Summary: three projects, two elements, prospect of low cost mining!**

Blue Sky Uranium is a real early stage chance at an imminent uranium boom market. Although the company has already made significant exploration and development progress on its three advanced projects within Amarillo Grande, an initial resource estimate which is planned for the fourth quarter of 2017 may bring clarity on the dimension of the resources at Ivana. Two things seem objectively speaking crystal clear: First, the rocks at Ivana and also at Anit contain,

besides uranium, significant vanadium resources also and second, the existing resources can be mined most likely by open pit mining methods. Together this promises, due to several existing high-grade sections, a very good chance for an early production and especially for a low-cost production which needs only a fraction of the capital costs that similar conventional mines require. An own production should be within the realms of possibility with the very well networked Grosso Group in Argentina. In December 2017 Blue Sky Uranium completed an oversubscribed financing of CA\$1.12 million. An additional also oversubscribed financing of CA\$1.45 million was realized in February 2018. Both oversubscribed financings clearly show that many investors are convinced by the development of Blue Sky Uranium.

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## **Exclusive interview with Nikolaos Cacos, CEO of Blue Sky Uranium**

### ***What did you and your company achieve within the last 12 months?***

Our drilling continues to reveal high-grade uranium intercepts within poorly consolidated sediments near surface, building our understanding of the deposit and its potential. The Ivana target has the largest, highest-grade zone of uranium mineralization found at the Amarillo Grande uranium-vanadium project to date, and understanding it fully is the key to uncovering the potential of the 140-kilometre-long mineral belt controlled by Blue Sky. We are an excellent candidate to be the first low-cost, near-term domestic uranium supplier in Argentina. Three main properties with zones of near-surface mineralization within a 140km trend

discovered by Blue Sky and is open for expansion – mineralized sequences believed to be preserved along the trend. Leachable mineralization; upgradeable through a simple low-cost wet screening technique. Exclusive rights to over 287,000 hectares with this information we are moving toward a resource estimate and a PEA.

### ***What are the main catalysts for your company within the next 6 months?***

We are working on a resource estimate to be completed in March (43-101) and then on to a Preliminary economic assessment targeted to be completed by July.



*Nikolaos Cacos, CEO*



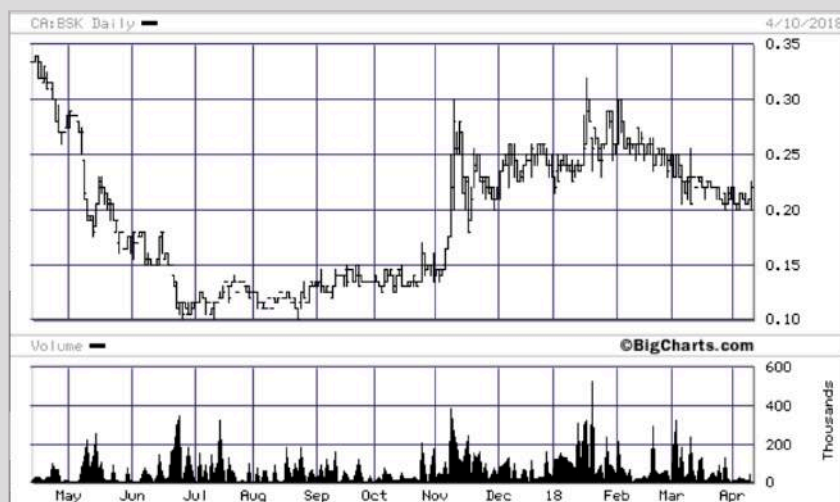


***What is your opinion about the current conditions of the uranium market?***

The \$20 per pound range is a crisis price for the uranium industry. Prices are now so low that most uranium mines are losing money on every pound they sell at spot pricing. All U.S. uranium mines are losing money at current prices. The reality is that nuclear energy has provided – and continues to provide – the world with massive amounts of clean, safe, emission-free electric power. Coal, which is also used to generate electricity, has killed far, far more people than uranium. The average citizen in nuclear energy capabilities doesn't know the vital role that nuclear power plays in their economy. America gets 21% of its electricity from nuclear power. Nuclear power provides electricity for about 23 million homes in the US, or about twice the number of homes in California. A portion of an ounce of uranium contains the equivalent ener-

gy of 6,613,868 pounds of coal. It would take 2 million grams of oil or 3 million grams of coal to equal the power contained in 1 gram of uranium fuel. Unlike oil and coal, nuclear fuel is recyclable and, in a breeder reactor, can actually produce more fuel than is used up! For these reasons, nuclear energy is by far the best means now available to power a modern industrial economy. Seasoned resource investors know that one of the ultimate signs of a market bottom is when the current market price of a resource is lower than an industry's lowest cost of production. When this situation occurs, either the price of the resource goes up or the producers go out of business and the world goes without the resource. In the case of energy resources, the world always chooses to keep the cars running and the lights on.

## Blue Sky Uranium Corp.



(Source: BigCharts)

**ISIN:** CA0960495079  
**WKN:** A12GAR  
**FRA:** MAL2  
**TSX-V:** BSK

Shares issued: 77.6 million  
Options: 4.8 million  
Warrants: 10.4 million  
Fully diluted: 92.9 million

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