

## Uranium (Q4, 2013 and Q1, 2014)

### Insight: When, not if

For me, it's not a question of if the spot and term prices will increase from their current lows but when.

The short-term outlook remains depressed, the uranium spot and term prices continue to fall, the level of contracting is significantly down on previous years and a number of miners face cashflow pressures as the spot price is close to or below operating costs.

However, the longer term view is that the current supply overhang will clear leaving a supply gap as China ramps up its nuclear fleet.

When forming views on the uranium market, it's critical to stand back and consider nuclear energy's vital role in the global energy mix. The ongoing Russia-Ukraine crisis heightens the importance of national energy security and having a diverse energy mix. The longer term sovereign hand is being played out in the number of recent country-to-country agreements promoting nuclear infrastructure and trade. The sovereign significance is also seen in the recent investment by the China National Nuclear Corporation in the Langer Heinrich mine securing supply for China.

The timing of the expected recovery hinges on signals of Japanese restarts and the pace of ramp up of the Chinese fleet. At the moment, utilities are sitting on their hands until the supply/demand equation becomes clearer. The supply/demand balance could easily change dramatically if a supply disruption event was to occur.

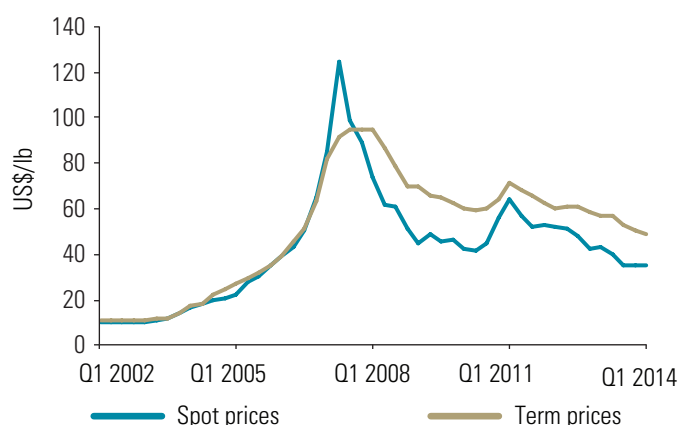
### Uranium price trends

Uranium spot prices continued their declining trend in 2013, falling 21.3 percent to average at about \$38/lb US dollars (US\$). Long-term contract prices also declined, although at a lower rate of 10 percent to average at about US\$54/lb. This price drop is largely attributed to the decreased demand from Japan due to the idling of its nuclear capacity since 2011, post the Fukushima incident, seen in significantly reduced contracting volumes. Moreover, there was a 3.7 percent year-over-year increase in primary uranium production which created a supply surplus in the market and pulled down uranium prices. The spot and term prices declined by 0.2 and 2.7 percent quarter-on-quarter to reach about US\$35/lb and US\$49/lb respectively during Q1, 2014.

“When forming views on the uranium market, it's critical to stand back and consider nuclear energy's vital role in the global energy mix.”

**Derek Meates**  
KPMG in Canada

**Figure 1: Prices of uranium, Q1, 2002–2014**

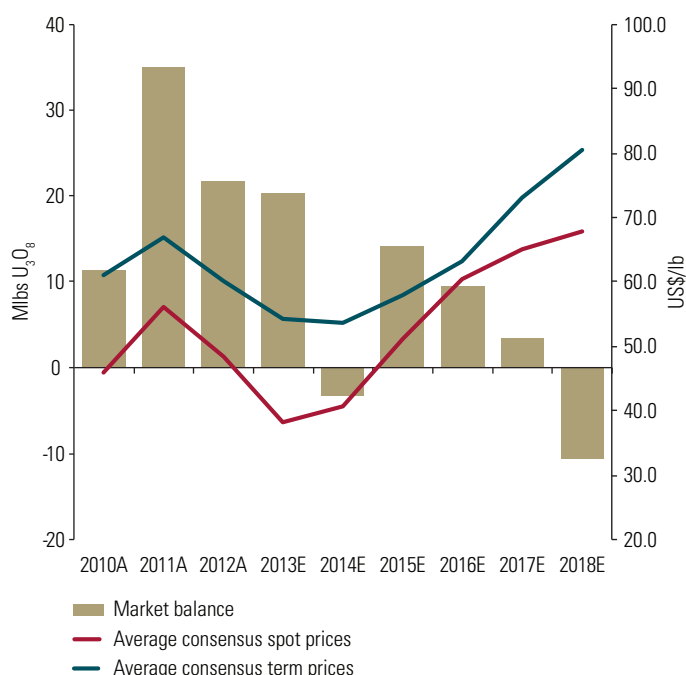


Source: Spot price history, Cameco, [http://www.cameco.com/investors/markets/uranium\\_price/](http://www.cameco.com/investors/markets/uranium_price/), accessed 19 May 2014; Resources and energy quarterly, Bureau of Resources and Energy Economics (BREE), Australia, <http://www.bree.gov.au/publications/resources-and-energy-quarterly>, accessed 19 May 2014; KPMG analysis.

In 2014, the uranium market is expected to tighten as secondary supplies from the Russia-US Megatons to Megawatts program (MMP) discontinue and the Chinese continue to build their inventory. Although a small number of reactors in Japan could resume operation in 2014, this is not expected to have any immediate significant effect on demand as the Japanese already have sufficient uranium stocks to re-start some of their nuclear plants but will likely lift prices as Japan restarts is a key market signal for the uranium industry.

Moving ahead, the uranium market balance is expected to tighten post 2015, due to the rapid growth of China's nuclear power industry. Also, in the event that scheduled risks delay the start of new mines or their ramp-up to full production, a supply shortfall, which could support even higher prices, may occur. Uranium prices are expected to increase above US\$65/lb by 2018.

**Figure 2: Market balance vs. prices, 2010–2018E**



Source: BMO Capital Markets – Global commodities research – Commodities canvas – Q2/14: Seasonal challenges and opportunities (Report), 16 April 2014; Morgan Stanley – Metal sparks: Supply side to fuel uranium restart, 12-Feb-14; BMO Capital Markets – Mining & commodity roundup, 12 May 2014; UBS Research – Commodity drillbit, – Mining benchmarker – Morgan, 8 May 2014; Laurentian Bank Securities – Q2/14 commodity price and financial forecast review, 24 April 2014; Renaissance capital – Global mining: Harvest time, cash flowing back to shareholders; RBC Capital Markets – Precious metals & minerals weekly valuation tables: Chart of the week: Updating EV/SCF valuations, 17 March 2014; Credit Suisse – Commodities advantage: Rate hints, China winks, 20 March 2014; J.P. Morgan – Cameco corp., 29 April 2014; via Thomson research/Investext, accessed May 2014; KPMG analysis.

## Russia–Ukraine crisis

The uranium market is not immune to the potential fallout from the Russia-Ukraine crisis. Russia is the world's sixth-largest producer of primary uranium and has substantial amounts of secondary supply of enriched uranium.<sup>1</sup> Russia is deeply involved in the nuclear sector across a dozen European countries through the Russian energy strategy, which promotes the export of Rosatom nuclear technology and expertise and has ambitious growth targets.

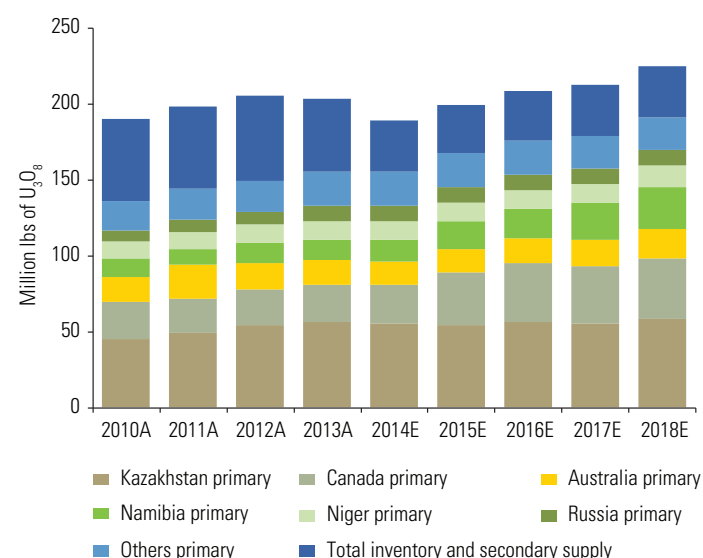
Moreover, Russia still enjoys significant political clout over Kazakhstan, an ex-Soviet country, which is the largest producer of uranium globally.

As you will see later on in the regulatory update section there has been a significant number of agreements reached between countries laying the groundwork for investment in nuclear infrastructure and export markets. These agreements absolutely have a political aspect with the US, Russia, UK and China involved.

## Supply and demand<sup>2</sup>

### Supply

**Figure 3: Global uranium supply, 2010–2018E**



Source: BMO Capital Markets – Global commodities research – Commodities canvas – Q2/14: Seasonal challenges and opportunities (Report), 16 April 2014, via Thomson research/Investext, accessed May 2014; KPMG analysis.

- Primary uranium production in the country increased 3.7 percent from 149.2mlbs in 2012 to 154.7mlbs in 2013 with production increases from existing mines in Kazakhstan, which were partially offset by disruptions at a few mines including the Ranger mine in Australia.
- Global primary uranium production is expected to increase at a CAGR of 4.2 percent from 154.7mlbs in 2013 to 190.4mlbs in 2018. The key drivers of this increase are the commissioning of Cigar Lake in Canada, Husab project in Namibia, Imouraren project in Niger and ramp-up in mines in Kazakhstan to production capacity. Cigar Lake is a world-class high-grade mine with a target production of 18 mlbs per annum. This would more than offset the production loss from the Kayelekera mine in Malawi and Ranger mine in Australia.
- Kazakhstan is expected to remain the world's largest uranium-producing country (producing about 30.4 percent of the global production in 2018) growing at a CAGR of 0.6 percent from 56.3mlbs in 2013 to 57.9mlbs in 2018. The growth will be supported by ramp-up in production at Akbastau, Kharasan North and Kharasan South. There is expected to be production decline over the next 2 years, in response to lower market prices — however, it is projected to rebound later in the outlook period as demand gathers pace.

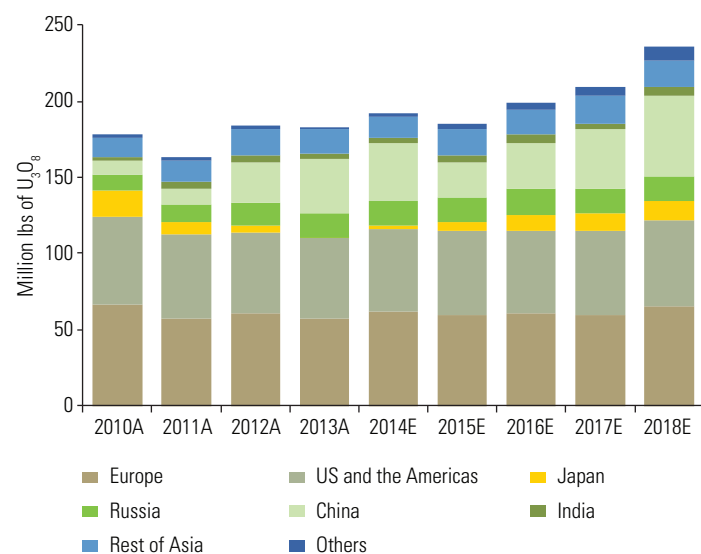
<sup>1</sup> BMO Capital Markets – Global commodities research – Commodities canvas – Q2/14: Seasonal challenges and opportunities (Report), 16 April 2014, via Thomson research/Investext, accessed May 2014

<sup>2</sup> "Resources and Energy Quarterly", Bureau of Resources and Energy Economics, Australian Government, March Quarter 2014; CIMB Research – Resetting the fuse..., 2 April 2014; BMO Capital Markets – Global commodities research – Commodities canvas – Q2/14: Seasonal challenges and opportunities (Report), 16 April 2014, via Thomson research/Investext, accessed May 2014

- Production from Canada is expected to grow at a CAGR of 10.6 percent to 39.8mlbs in 2018 from 24.1mlbs in 2013. This increase is expected to be driven by Cameco's Cigar Lake mine, which is projected to reach full operating capacity by 2018, making it the second-largest uranium mine in the world after the McArthur River mine, also in Canada. Cameco recently declared first production from Cigar Lake in March 2014. This could be partially offset by the completion of mining from the Eagle Point underground mine (processing at Rabbit Lake mill) around 2018.
- Inventory and secondary supply, which declined by 13.4 percent year-over-year in 2013 due to lower Russian high-enriched uranium (HEU) supplies, is expected to further decline from 48.5mlbs in 2013 to 34.1mlbs in 2018 at a CAGR of 6.8 percent. This decline can be attributed to the completion of the MMP in December 2013.
- With the last shipment of HEU being completed in late 2013, the actual effects of the decline could take a number of months to become visible as the lag between shipment and reactor loading would mean uranium sold through the HEU program will be used for a number of months to come. Also, previously Russia was able to supply the US with only small quantities of uranium in addition to that supplied under the MMP. However, from 2014 till 2020 the US import quota from Russia has been increased to 20 percent of the US consumption.
- Uranium demand is expected to increase at a CAGR of 5.2 percent from 182.9mlbs in 2013 to 235.2mlbs in 2018, driven mainly by China's nuclear industry, which has set a revised target of 58GW of nuclear capacity by 2020. Of the 72 under-construction nuclear reactors globally, 30 are based in China, and the country is expected to continue stockpiling uranium in preparation for this build-out.
- This nuclear expansion is expected to be partially offset by some permanent reactor shutdowns in Japan and Germany. Of the 50 Japanese nuclear reactors pre-Fukushima, currently only 17 are undergoing a safety review to potentially restart while Germany has committed to removing its nuclear reliance by 2022. It will be interesting to observe whether the German policy stands the test of time given the dependence on Europe for Russian gas.
- Obviously, Japan has substantially reduced its uranium consumption post the Fukushima incident. The new government of Japan has released its draft Basic Energy Plan in February 2014 indicating support to the country's nuclear industry. Nuclear power plant operators have lodged applications with the Nuclear Regulation Authority to restart 17 reactors and it is expected that up to six of these could restart during Q2, 2014 after thorough safety requirement tests and inspection. The country's nuclear demand is expected to increase at a CAGR of 85 percent from 0.6mlbs in 2013 to 13mlbs in 2018. This will be about 75 percent of the pre-Fukushima level of 17.3mlbs in 2010.

## Demand

**Figure 4: Global uranium demand, 2010–2018E<sup>3</sup>**



Source: BMO Capital Markets – Global commodities research – Commodities canvas – Q2/14: Seasonal challenges and opportunities (Report), 16 April 2014, via Thomson research/Investext, accessed May 2014; KPMG analysis.

- Global uranium demand declined by 0.3 percent from 183.5mlbs in 2012 to 182.9mlbs in 2013. There was a significant demand increase of 35.1 percent year-over-year from China due to the commissioning of two new reactors. However, this was more than offset by an 87.2 percent decline in demand from Japan where demand remained very low relative to pre-Fukushima levels.
- In Europe, nuclear power capacity is projected to grow at a CAGR of 2.3 percent from 57.8mlbs in 2013 to 64.8mlbs in 2018. While some OECD economies in Western Europe are moving away from nuclear power, the growth in Eastern Europe is expected to more than offset the scheduled reactor closures in countries such as Germany and Belgium. While France is expected to remain the largest consumer of uranium in Europe, Russia is expected to drive demand growth with up to 10 reactors scheduled to start operating by 2019.
- The US was the world's largest nuclear energy producer with over 102.2GW of capacity in 2012. This capacity fell to 96.9GW in 2013 after five nuclear reactors (Kewaunee, Crystal River 3, San Onofre-2, San Onofre-3 and India Point 2) were shut down. However, this decline is expected to be more than offset by opening of five new reactors, which are under construction (Watts bar 2, Vogtle 3, Vogtle 4, V.C. summer 2 and V.C. summer 3), as they have relatively high power capacities.<sup>4</sup> The total uranium demand from the US and the Americas is expected to increase at a CAGR of 1.6 percent from 52.4mlbs in 2013 to 56.7mlbs in 2018.

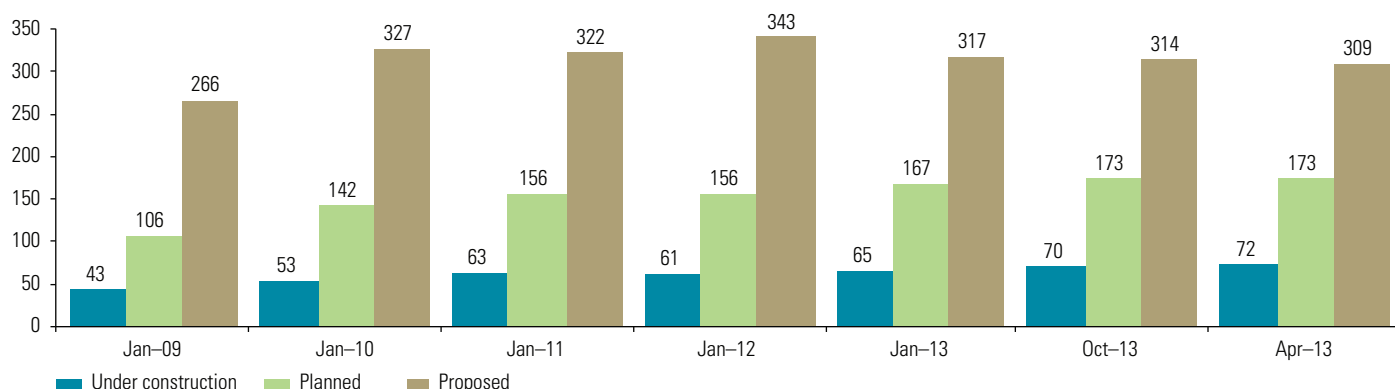
The number of proposed nuclear reactors declined to 309 as of April 2014, compared to 314 in October 2013. However, the number of under-construction reactors increased to 72 from 70 in October 2013, whereas the number of planned nuclear reactors remained steady at 173.<sup>5</sup>

<sup>3</sup> Demand forecast includes buffer inventories

<sup>4</sup> "Nuclear Power in the USA," World Nuclear Association, 15 May 2014

<sup>5</sup> World Nuclear Power Reactors & Uranium Requirements, World Nuclear Association, <http://world-nuclear.org/info/Facts-and-Figures/World-Nuclear-Power-Reactors-and-Uranium-Requirements/>, accessed 20 May 2014

**Figure 5: Number of nuclear reactors, January 2009 – April 2014**



Source: World Nuclear Power Reactors & Uranium Requirements, World Nuclear Association, <http://www.world-nuclear.org/info/Facts-and-Figures/World-Nuclear-Power-Reactors-and-Uranium-Requirements/>, accessed 20 May 2014.

## Key developments

### Ownership changes

There was limited transaction activity in Q4, 2013 and Q1, 2014. The total number of deals remained at two during both Q1, 2014 and Q4, 2013. The total value of deals increased to US\$205 million in Q1, 2014 from US\$49 million in Q4, 2013.

The investment by China National Nuclear Corporation in 25 percent of the Langer Heinrich mine in Namibia is worth mentioning as it reaffirms the sovereign interest in securing uranium supply.

**Figure 6: Major deals in the uranium industry**



Source: Mergermarket accessed 19 May 2014; KPMG analysis.

**Table 1: Uranium deals announced in Q1, 2014 and Q4, 2013**

Date announced	Target	Country (target)	Acquirer	Country (acquirer)	Status	Value of transaction (US\$ million)	Stake (%)
26-Feb-14	Azarga Resources Limited	Hong Kong	Powertech Uranium Corp.	USA	Announced	15.0	100
20-Jan-14	Langer Heinrich uranium mining operations	Namibia	China Uranium Corporation Limited	China	Announced	190.0	25
11-Dec-13	Witwatersrand Consolidated Gold Resources Limited	South Africa	Sibanye Gold Limited	South Africa	Completed	39.0	100
30-Oct-13	Uranium One Inc. (conventional uranium assets)	USA	Black Range Minerals Limited	Australia	Abandoned	10.0	100

Source: Mergermarket, accessed 19 May 2014.

## Regulatory updates

During Q4, 2013 and Q1, 2014, the regulators continued the focus on safety and compliance with the environmental regulations. Also, licenses were extended

to certain projects and the government intervened with royalty exemptions and initiatives to aid in the development of the uranium mining industry.

**Table 2: Recent regulations in the uranium industry**

Country	Regulation	Description
Sweden	Fuel processing <sup>6</sup>	<ul style="list-style-type: none"> <li>The Swedish Radiation Safety Authority (SSM) has recommended to the government that 835kg of plutonium from the Oskarshamn nuclear power plant's spent fuel remain in the UK and be used for fabricating mixed-oxide (MOX) fuel for reactors rather than be returned to Sweden as MOX fuel.</li> <li>The spent fuel was originally sent from Sweden to the Sellafield reprocessing plant in the UK from 1970 to 1984 under a 1969 agreement.</li> </ul>
US	Revising protection standards <sup>7</sup>	<ul style="list-style-type: none"> <li>US Environmental Protection Agency (EPA) is considering revising its 1977 uranium fuel cycle rule or "Environmental Radiation Protection Standards for Nuclear Power Plant Operations" for limiting exposures to radiation from commercial nuclear waste.</li> <li>This is being considered because the plan to construct a permanent waste repository at Yucca Mountain was abandoned, leading to power plants storing their waste onsite.</li> </ul>
US	License exemption <sup>8</sup>	<ul style="list-style-type: none"> <li>Nuclear Regulatory Commission (NRC) has issued a license exemption to Uranerz Energy Corporation in response to their annual financial assurance update for the Nichols Ranch uranium in situ recovery (ISR) project.</li> </ul>
US	Crafting of Safe Drinking Water Act (SDWA) waivers <sup>9</sup>	<ul style="list-style-type: none"> <li>EPA is urging states and industry to involve it earlier in the process of creating SDWA permit exemptions for underground injection.</li> <li>As per the EPA, the waivers are facing growing challenges from third parties and earlier involvement of EPA in the process could strengthen the rationale for the waivers.</li> </ul>
Niger	Abandoning of raising uranium royalties <sup>10</sup>	<ul style="list-style-type: none"> <li>Niger could abandon its attempts to increase royalties that French state-run nuclear power group Areva pays for the operation of uranium mines due to the fall of uranium prices.</li> <li>Areva's 10-year license for its two mines Somair and Cominak expired on 31 December 2013 and the company failed to sign another deal with the government by the end of 2013.</li> </ul>
US	Regulations amendment <sup>11</sup>	<ul style="list-style-type: none"> <li>NRC proposed to amend its regulations for material control and accounting (MC&amp;A) of special nuclear material (SNM) to revise and consolidate the MC&amp;A requirements.</li> <li>It would add new requirements that will apply to NRC licensees that are authorized to possess SNM in a quantity greater than 350 grams.</li> </ul>
US	State takeover of uranium and thorium mining regulation <sup>12</sup>	<ul style="list-style-type: none"> <li>Wyoming could self-regulate its uranium and thorium mining industries and take over the responsibility of regulating from the federal government.</li> <li>Though the mining industry has been asking the state to take over, it would take about US\$4.5 million and six years for it to happen.</li> </ul>

<sup>6</sup> "UK could use Oskarshamn plutonium as MOX fuel: Swedish regulators"; 31 March 2014, via Factiva, accessed May 2014

<sup>7</sup> "As Plants Store Nuclear Waste, Epa Weighs Revising Protection Standards"; 19 February 2014, via Factiva, accessed May 2014

<sup>8</sup> "Nrc Issues Notice About Uranerz Energy License Exemption"; 6 February 2014, via Factiva, accessed May 2014

<sup>9</sup> "Facing Growing Scrutiny, EPA Seeks Earlier Role To Bolster SDWA Waivers"; 31 January 2014, via Factiva, accessed May 2014

<sup>10</sup> "Niger may draw back from raising uranium royalties"; 6 January 2014, via Factiva, accessed May 2014

<sup>11</sup> "Amendments to Material Control and Accounting Regulations – Federal Register Extracts"; 8 November 2013, via Factiva, accessed May 2014

<sup>12</sup> Stephanie Joyce "State takeover of uranium mining regulation would cost at least \$4.5 million"; Wyoming public media, 2 December 2013



**Table 3: Recent agreements in the uranium industry**

Counties involved	Agreement	Description
Russia and UK	Reviewing initial agreement <sup>13</sup>	<ul style="list-style-type: none"> <li>The UK Department of Energy and Climate Change (DECC) is reviewing its initial agreement with Russian state-owned nuclear company Rosatom due to the continuing political situation in Ukraine.</li> <li>The initial deal was signed in September 2013 to study the possibilities of agreeing to nuclear commercial co-operation that would involve Rosatom building and maintaining nuclear power plants in the UK.</li> </ul>
India and US	Insurance plan for nuclear plants <sup>14</sup>	<ul style="list-style-type: none"> <li>India proposed an insurance plan to the US on 12 March 2014 regarding nuclear supplies to India.</li> <li>State-owned General Insurance Company (GIC) has been asked to devise the package.</li> </ul>
Iran and Russia	Nuclear plants <sup>15</sup>	<ul style="list-style-type: none"> <li>In March 2014, Iran and Russia signed an agreement to build two more nuclear power plants in the southern Iranian city of Bushehr.</li> <li>The agreement also includes the construction of two desalination plants.</li> </ul>
Finland and Russia	Strategic nuclear agreement <sup>16</sup>	<ul style="list-style-type: none"> <li>On 25 February 2014, Russia signed a strategic agreement with Finland for peaceful use of nuclear energy.</li> <li>The agreement establishes a legal basis for future cooperation between Russia and Finland in the field of nuclear technologies.</li> </ul>
US and Vietnam	Civilian nuclear agreement <sup>17</sup>	<ul style="list-style-type: none"> <li>A proposed civilian nuclear agreement was signed between the US and Vietnam on 24 February 2014. The agreement could open the way for the sale of US reactors and nuclear material to Vietnam.</li> <li>President Obama signed a presidential determination to signal that his office found that export of US-produced reactors or nuclear material would not pose an unreasonable risk to US security.</li> </ul>
Jordan and US	Capacity building <sup>18</sup>	<ul style="list-style-type: none"> <li>Jordan Nuclear Regulatory Commission (JNRC) signed a contract with the Advanced Systems Technology and Management, Inc. (AdSTM), US, on 10 February 2014, to boost the capacity of the commission in licensing the Jordan Research and Training Reactor.</li> <li>The US\$1.9 million, 30-month contract aims at boosting the capacity of the commission's technical team and providing oversight over all phases of the Jordanian Research and Training Reactor (JRTR) project.</li> </ul>
China, Japan and South Korea	Network to quickly exchange information <sup>19</sup>	<ul style="list-style-type: none"> <li>The three countries agreed to form a network on 4 December 2013 to quickly exchange information in a nuclear emergency such as the Fukushima-Daiichi accident.</li> </ul>
South Korea and US	Extension of agreement <sup>20</sup>	<ul style="list-style-type: none"> <li>The US Senate, on 27 January 2014, passed a bill on extending the current agreement with South Korea on civilian nuclear cooperation by two years.</li> <li>The current version of the allies' nuclear energy partnership agreement was signed in 1974 and was set to expire in March 2014.</li> </ul>
Iran and the six world powers (China, France, Germany, Russia, UK, and the US)	First-phase agreement <sup>21</sup>	<ul style="list-style-type: none"> <li>Iran and six world powers reached a first-phase agreement on a six-month deal that will halt Iran's most-sensitive nuclear activities and increase international monitoring of its nuclear program in exchange for some relief from sanctions on it.</li> <li>The deal was signed in Geneva on 24 November 2013.</li> </ul>
Canada and Kazakhstan	Civilian nuclear agreement <sup>22</sup>	<ul style="list-style-type: none"> <li>Canada entered a civilian nuclear agreement with Kazakhstan on 13 November 2013.</li> <li>Kazakhstan is home to 12 percent of the world's uranium deposits and an ambitious fuel cycle industry.</li> </ul>
China and Pakistan	Nuclear reactor deal <sup>23</sup>	<ul style="list-style-type: none"> <li>Pakistan is acquiring two large nuclear power reactors from its longtime ally China in a US\$9.1 billion deal.</li> <li>The reactors covered by the deal would be technologically advanced and built outside the main port city of Karachi. Each would provide 1,000 megawatts of electricity, a big boost for power-starved Pakistan.</li> </ul>

<sup>13</sup> "Argus Media Limited: UK government reviews Russian nuclear deal," 26 March 2014, via Factiva, accessed May 2014

<sup>14</sup> "India gives US insurance plan for nuclear plants," 14 March 2014, via Factiva, accessed May 2014

<sup>15</sup> "Iran and Russia sign on to build more nuclear plants at Bushehr," 12 March 2014, via Factiva, accessed May 2014

<sup>16</sup> "Finland : Russia joins hand with Finland for strategic nuclear agreement," 4 March 2014, via Factiva, accessed May 2014

<sup>17</sup> "US-Vietnam nuclear deal clears first hurdle with Obama approval," 25 February 2014, via Factiva, accessed May 2014

<sup>18</sup> "Jordan, US firm sign 1.9m dollar nuclear agreement – website," 11 February 2014, via Factiva, accessed May 2014

<sup>19</sup> "World News: Tokyo, Seoul and Beijing Propose Nuclear Pact," 5 December 2013, via Factiva, accessed May 2014

<sup>20</sup> "US Senate passes bill extending civil nuclear deal with South Korea," 28 January 2014, via Factiva, accessed May 2014

<sup>21</sup> "Iran, P5+1 Sign Nuclear Agreement," 1 December 2013, via Factiva, accessed May 2014

<sup>22</sup> "Canada, Kazakhstan : Canada projects to enter civilian nuclear agreement with Kazakhstan," 13 November 2013, via Factiva, accessed May 2014

<sup>23</sup> "World News: China-Pakistan Reactor Deal Spurs Concern," 16 October 2013, via Factiva, accessed May 2014

## Cross-section of global uranium projects

**Table 4: Cross-section of global uranium projects**

Project	Country/Region	Operators	Capex (US\$ million)	Initial production	Annual uranium capacity (Mlbs)
Akbastau Uranium mine	South Kazakhstan province, Kazakhstan	Akbastau JV JSC	608.5	2009	5.0
Cigar Lake Uranium project	Saskatchewan, Canada	Cameco Corporation	2,600.0	2014	18.0 <sup>24</sup>
Etango Uranium deposit	Namib desert sands, Namibia	Bannerman Resources Limited	870.0 <sup>25</sup>	N/A	6.0–9.0
Husab Uranium deposit	Swakopmund, Namibia	Swakop Uranium (Pty) Ltd	1,480.0	2015	N/A
Kvanefjeld Uranium/Rare Earth project	Nuuk, Greenland	Greenland Minerals and Energy Limited	810.0	N/A	At least 1 Mlb
Madaouela Uranium project	Agadez, Niger	Goviex Uranium Inc.	646.0	N/A	2.5
Michelin Uranium deposit	Newfoundland and Labrador, Canada	Paladin Energy Ltd.	984.0 <sup>26</sup>	N/A	5.7
Roughrider Uranium deposit	Saskatchewan, Canada	Rio Tinto plc	567.0	N/A	N/A
Trekkopje Uranium mine	Walvis bay, Namibia	Areva SA	602.9	N/A	N/A
Imouraren Uranium mine	Arlit, Niger	Areva NC	N/A	2015	N/A
McArthur River mine	Saskatchewan, Canada	Cameco Corporation	3,500.0	1999	21.0
Langer Heinrich uranium mine	Walvis Bay, Namibia	Paladin Energy Ltd.	142.0	2007	5.2
Ranger Uranium mine	Northern Territory, Australia	Energy Resources of Australia Ltd	N/A	1980	11.1
Karatau Uranium mine	Ongtustik, Kazakhstan	Uranium one Inc.	N/A	2009	5.2
Rossing Uranium mine	Swakopmund, Namibia	Rio Tinto Ltd	N/A	1976	9.9
Olympic Dam Copper/ Uranium mine	South Australia, Australia	BHP Billiton Ltd	N/A	1988	8.8
Inkai Uranium mine	Ongtustik, Kazakhstan	Joint Venture Inkai Limited Liability Partnership	359.2 <sup>27</sup>	2009	5.2
Rabbit lake Uranium mine	Saskatchewan, Canada	Cameco Corporation	N/A	1975	11.0
South Inkai Uranium mine	Ongtustik, Kazakhstan	Atomredmetzoloto JSC	N/A	2009	5.2
Kayelekera Uranium mine	Karonga, Malawi	Paladin Energy Ltd.	182.0	2009	3.3
Kharasan Uranium Mine	Qyzylorda, Kazakhstan	Uranium one Inc.	N/A	2009	7.8
Kintyre Uranium deposit	Western Australia, Australia	Cameco Corporation	600*	N/A	6.0
Yeelirrie Uranium deposit	Western Australia, Australia	Cameco Corporation	650*	N/A	7.7
Wiluna Uranium project	Western Australia, Australia	Toro Energy Ltd	269*	2015	1.7

The above table includes projects with capex exceeding US\$500 million and the top ten uranium projects by 2013 annual production. The list is not exhaustive and contains only a limited number of projects.

Source: Company data, BREE, Intierra.

<sup>24</sup> Production from the McClean Lake mill which will process all of Cigar Lake's mined uranium

<sup>25</sup> Pre-production capital costs

<sup>26</sup> Including US\$132 million contingency

<sup>27</sup> Remaining capital costs from 2010 to 2030





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