

The case for uranium

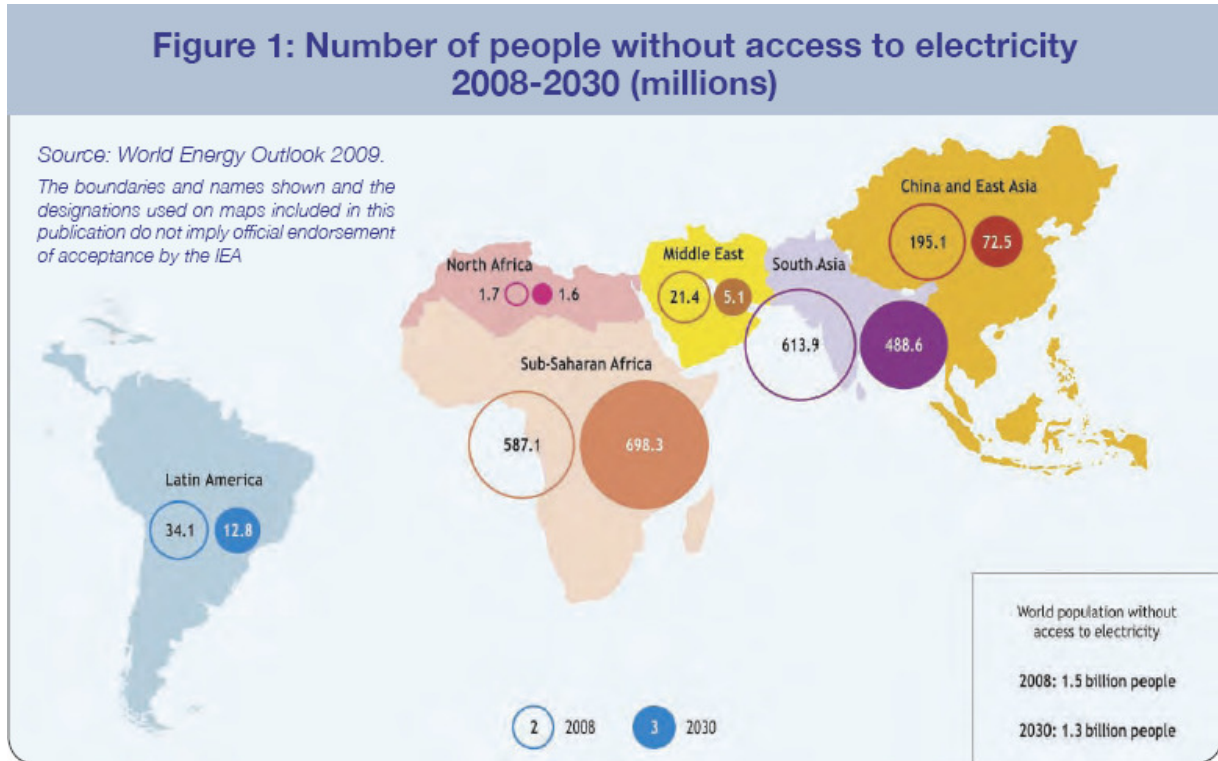
The spot market price for uranium ended 2010 at its highest level for over two years, reversing a declining trend in a year that also saw record spot market activity.

Summary

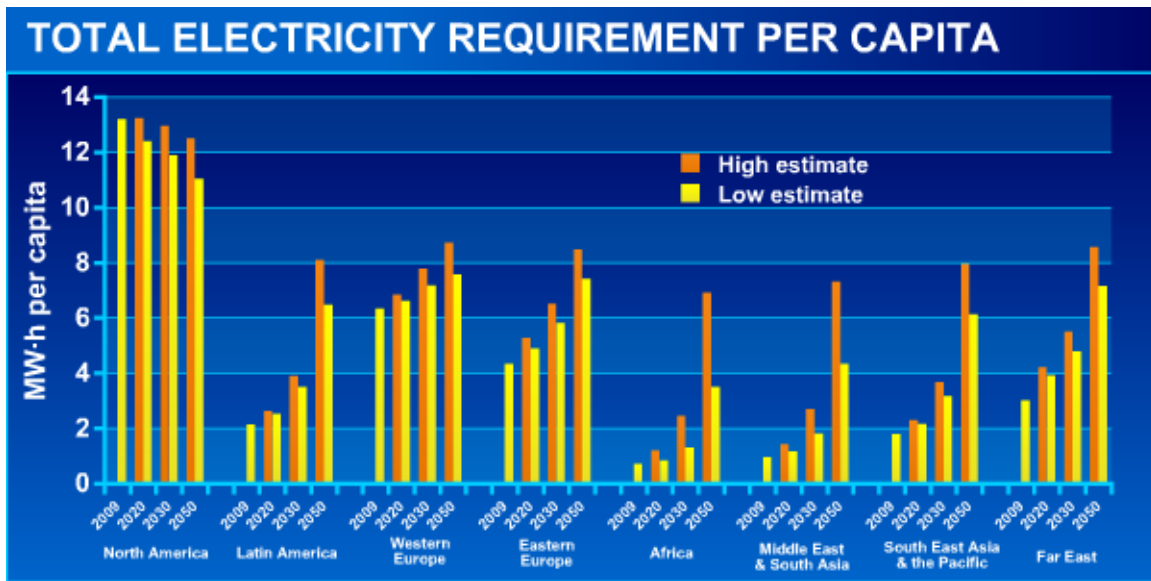
- Nuclear power generation is today the only viable and credible route to match growing electricity demand in fast expanding economies but also in the West to meet CO₂ emission reduction targets.
- A large portion of uranium mines are located in deemed “safe zones”.
- Uranium prices reached their top ahead of other commodities and lagged during the recovery phase: in 2010 and 2011, uranium prices substantially closed up the gap.
- I do not perceive a risk of shortage with expected increase in production from major providers and secondary source (new START agreement in particular) and therefore does not pose a constraint to an extension of nuclear energy; in case of major stress, stockpiles could be used (just below 3 years of mine production at 2010 rate of extraction).
- With incremental production required, prices will continue to move upwards for mines to be economically viable to match demand.
- The price of mined uranium is not as fundamental as oil as a usable combustible.
- 2007 peak was mostly speculative, nothing really happening on the field; actual move is based on fundamentals.
- Uranium shares recovery is spectacular and a correction is overdue. For the long term investor they represent an added leg to the energy/commodity secular theme.

1. Long term trend of electricity consumption/production

The world population without access to electricity amounted to 1.5 billion people in 2008 and will still represent 1.3 billion people in 2030.



According to the International Energy Agency, Electricity is the world's fastest-growing form of end uses energy consumption as it has been for the past several decades. **Net electricity generation worldwide will rise by 2.3 percent per year on average from 2007 to 2035**, while total world energy demand grows by 1.4 percent per year. This would represent a World **net electricity generation increase of 87%** (reference case), from 18.8 trillion KWh in 2007 to 25.0 trillion KWh in 2020 and **35.2 trillion KWh in 2035**. Non-OECD countries will account for 61 percent of world electricity use in 2035 (non-OECD increasing at 3 times the pace of OECD countries, at 3.3% / year).



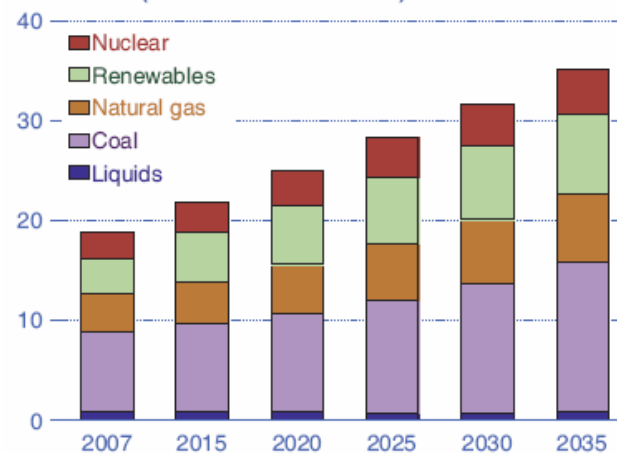
The 2007 sector consumption breakdown and annual growth until 2035 are as follows:

Residential	14%	+1.1%/annum to 2035
Commercial	7%	+1.7%/annum to 2035
Industrial	51%	+1.3%/annum to 2035
Transportation	27%	+1.3%/annum to 2035

2. Nuclear power generation

Nuclear power generation represents a small portion of the world total electricity production, whilst increasing from 2.6 trillion KWh in 2007 to 4.5 trillion KWh in 2035 as high fossil fuel prices (particularly from non-conventional sources or difficult to extract conventional ones) and concerns about security and greenhouse gas emissions support the development of new nuclear generating capacity.

Figure 18. World electricity generation by fuel, 2007-2035 (trillion kilowatthours)



Currently, the share of nuclear electricity generation varies widely from between regions and within OECD countries, from over 75% (France, Lithuania) to less than 5% (China, India, Brazil, The Netherlands, Pakistan, Mexico, South Africa).

Nearly 72 percent of the world expansion in installed nuclear power capacity is expected to take place in non-OECD countries, particularly China where estimates range widely in both timeframe and capacity; the IEA forecast China to add 66 GW by 2035 (China announced a total capacity of 40GW – some officials put the figure at 80 GW -in 2020 vs. 10.3 GW end 2010). For reference, in 2006, the world had 435 reactors located in 30 countries producing 370 GW; by 2035, 350 reactors are planned worldwide representing an electricity generation of 330GW. **According to the International Atomic Energy Agency, from 2012 ten or more new reactors will start every year, the first time since 1990.**

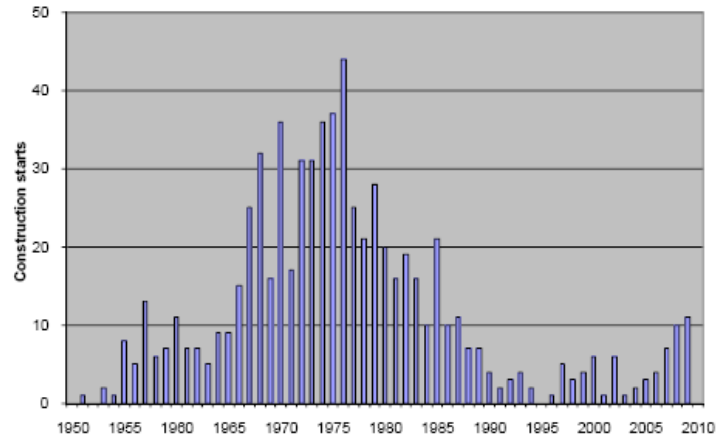
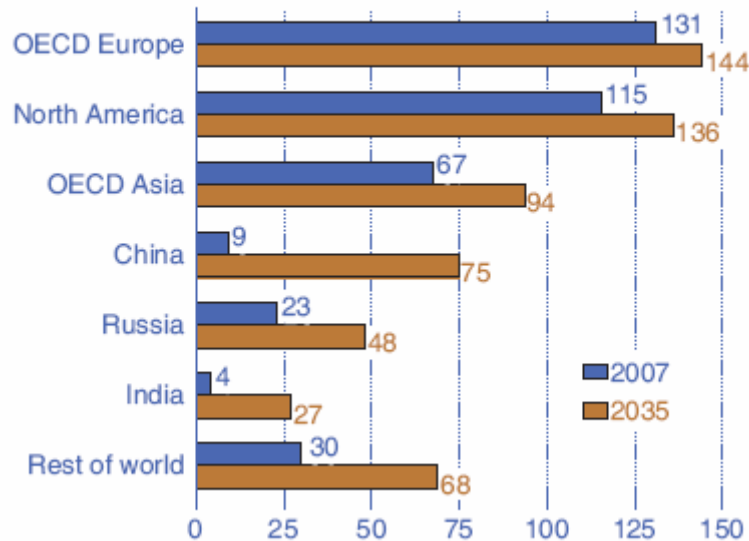
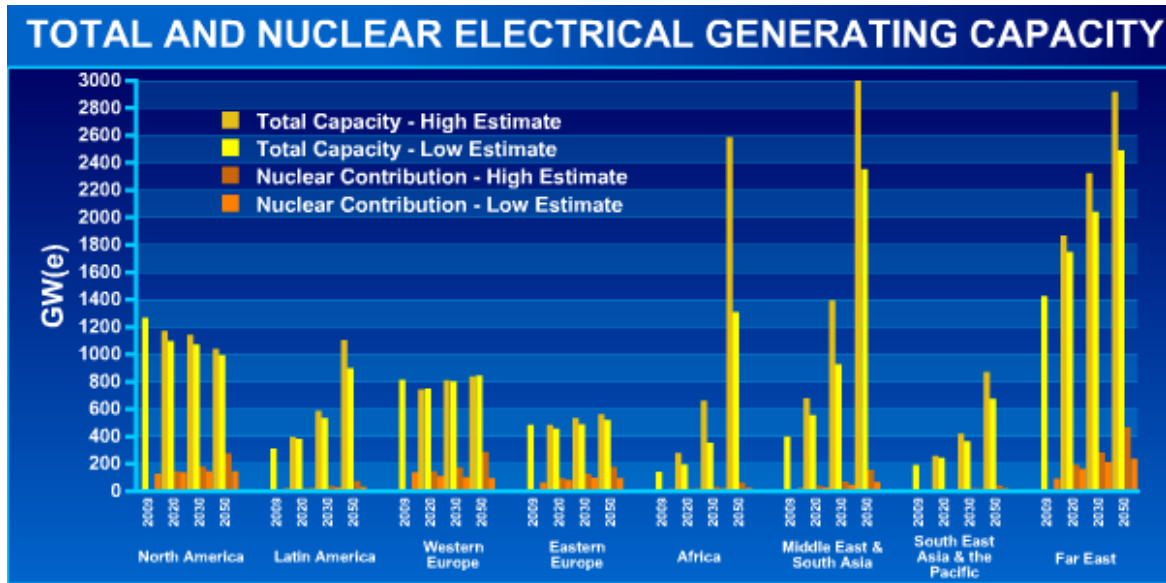


Figure 20. World nuclear generating capacity by region, 2007 and 2035 (gigawatts)



Furthermore, world average capacity utilization rates have continued to rise over time, from about 65 percent in 1990 to about 80 percent today, with some increases still anticipated in the future. In addition, most older plants now operating in OECD countries and in non-OECD Eurasia probably will be granted extensions to their operating licenses. Despite these developments, nuclear electricity will remain a small portion of the total production.

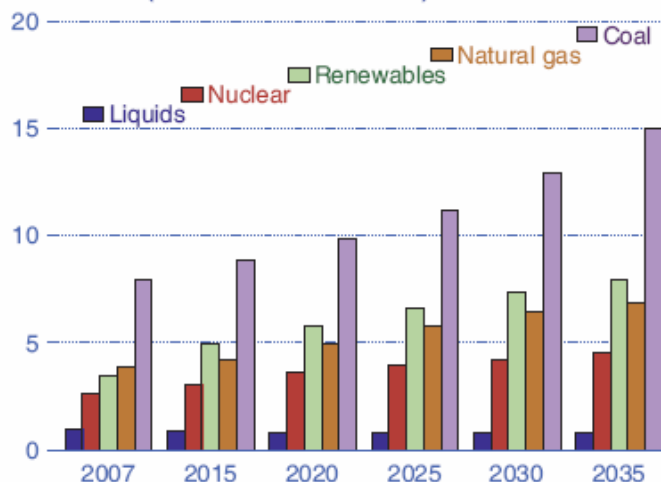


Notwithstanding the difficulty to forecast nuclear plant construction over the long term, **the IEA increased by 9 percent last year’s projection.**

In addition, **new technologies are being developed in the field of micro-nuclear reactors that could match an untapped sector so far.** The USA is developing an underground reactor technology of 140MW whilst France is well advanced with small offshore nuclear power plants of 50 to 250 MW.

Still, **there is considerable uncertainty associated with nuclear power projections.** Issues that could slow the expansion of nuclear power in the future include plant safety, radioactive waste disposal, rising construction, maintenance, and decommissioning costs as well as investment risks, traditional fossil energy prices, and nuclear material proliferation concerns.

Figure 70. World net electricity generation by fuel, 2006-2030 (trillion kilowatthours)



3. Uranium demand and supply

According to the World Nuclear Association, the world total production was 50,772 tU in 2009 (55,000 tU estimated for 2010 as production ramps up in Kazakhstan and Namibia):

- **About 63 percent of the world's production of uranium from mines is from Kazakhstan, Canada and Australia.**
- An increasing proportion of uranium, now 36%, is produced by in situ leaching.
- **After a decade of falling mine production to 1993, output of uranium has generally risen since then and now meets 76% of demand for power generation.**

World Uranium Production Data
(thousand pounds U₃O₈)

Country	2001	2002	2003	2004	2005	2006	2007	2008	2009
Kazakhstan	5,300	7,368	8,579	9,669	11,327	13,725	17,255	22,153	35,929
Canada	32,540	30,178	27,186	30,150	30,230	25,642	24,636	23,399	26,448
Australia	20,070	17,819	19,686	23,427	24,747	19,742	22,387	21,917	20,752
Namibia	5,821	6,070	5,293	7,898	8,182	8,000	7,485	11,351	12,027
Russia	5,200	7,539	8,189	8,319	8,920	8,839	8,873	9,154	9,266
Niger	7,590	7,997	8,171	8,532	8,041	8,928	8,197	7,883	8,431
Uzbekistan	6,240	4,836	4,602	5,241	5,980	5,902	6,032	6,078	6,315
USA	2,630	2,344	2,228	2,228	2,689	4,106	4,533	3,879	3,778
Ukraine	1,300	2,080	2,080	2,080	2,080	2,080	2,199	2,080	2,184
China	1,300	1,898	1,950	1,950	1,950	1,950	1,851	1,999	1,950
So. Africa	2,270	2,142	1,971	1,939	1,752	1,418	1,401	1,703	1,464
Brazil	151	702	806	780	286	494	777	858	897
India	520	598	598	598	598	598	702	705	754
Czech Rep	1190	1248	897	1071	1061	928	796	684	671
Malawi	0	0	0	0	0	0	0	0	270
Pakistan	60	99	117	117	117	117	117	117	130
TOTAL	93,013	93,951	92,977	104,451	108,441	102,833	107,550	114,373	131,482

Kazakhstan produces the largest share of uranium from mines (27% of world supply from mines), followed by Canada (20%) and Australia (16%). Namibia (+127%) is the fastest growing supplier after Kazakhstan (+352%).

The world's known uranium resources went up 15% in two years to 2007 due to increased mineral exploration since uranium recovery prices in 2003; the known recoverable resources of uranium were 5.4 million tU in 2009 with Australia holding 31% of this total, Kazakhstan 12%, Canada and the US 9% each (based on a market price of USD 130 / kg). This represents **80 years of supply at the current projected new reactors**. The World Nuclear Association (WNA) reference scenario projects world uranium demand as about 77,000 tU in 2015, and most of this will need to come directly from mines (in 2009, 24% came from secondary sources). China alone, would have consumed 15,000 tU

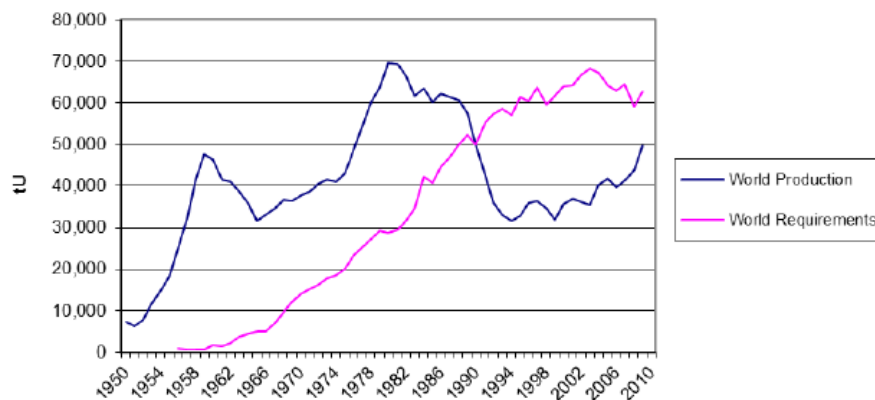
in 2010, 27% of world mines' production. The World Energy Council forecast demand to reach between 105,000 tU and 140,000 in 2030.

World Uranium Requirement Data (thousand pounds U₃O₈)

Country/Region	2001	2002	2003	2004	2005	2006	2007	2008	2009
USA	47,336	54,664	62,300	50,100	58,300	51,500	49,500	49,100	51,100
European Union	53,024	54,591	54,100	50,400	55,100	53,200	53,600	57,400	56,700
CIS/Non-EU	31,205	30,607	22,700	19,900	21,600	20,700	20,800	15,900	16,500
Asian Pacific	38,435	35,249	37,700	36,400	34,600	35,000	35,300	36,000	38,800
Other	7,089	8,546	8,100	8,100	8,400	10,700	9,100	9,600	10,100
TOTAL	177,089	183,657	184,900	164,900	178,000	171,100	168,300	168,000	173,200

Whilst demand has substantially increased over the past few years to reach an estimated 68,640 tU in 2010 (equivalent to 80,954 tU₃O₈), **production** has also significantly expanded and, **in 2009, covered approximately 76% of utilities' requirements.**¹

Figure 6.3 Global annual uranium production and reactor requirements*
(Source: adapted from NEA/IAEA, 2010)



* Production and reactor requirements are expressed in terms of tonnes (t) of contained uranium (U) rather than in terms of uranium oxide (U₃O₈). Data for 2009 are estimates

The balance is made up from secondary sources including (2009 data between brackets):

- recycled uranium and plutonium from spent fuel, as mixed oxide (MOX) fuel (1500-2000 tU)
- re-enriched depleted uranium tails (a few thousands tU)
- civil stockpiles (150,000 t U – unlikely to be reduced for strategic reasons)
- ex military weapons-grade plutonium, as MOX fuel (10,600 tU₃O₈ / yr)

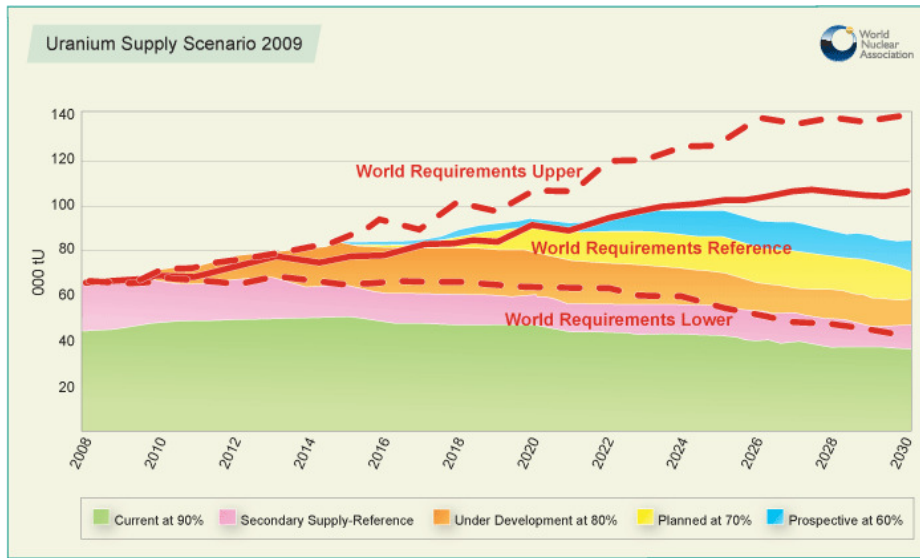
¹ 3 yardsticks to remember:

each GW of increased capacity will require about 200 tU/yr of extra mine production routinely, and about 400-600 tU for the first fuel load

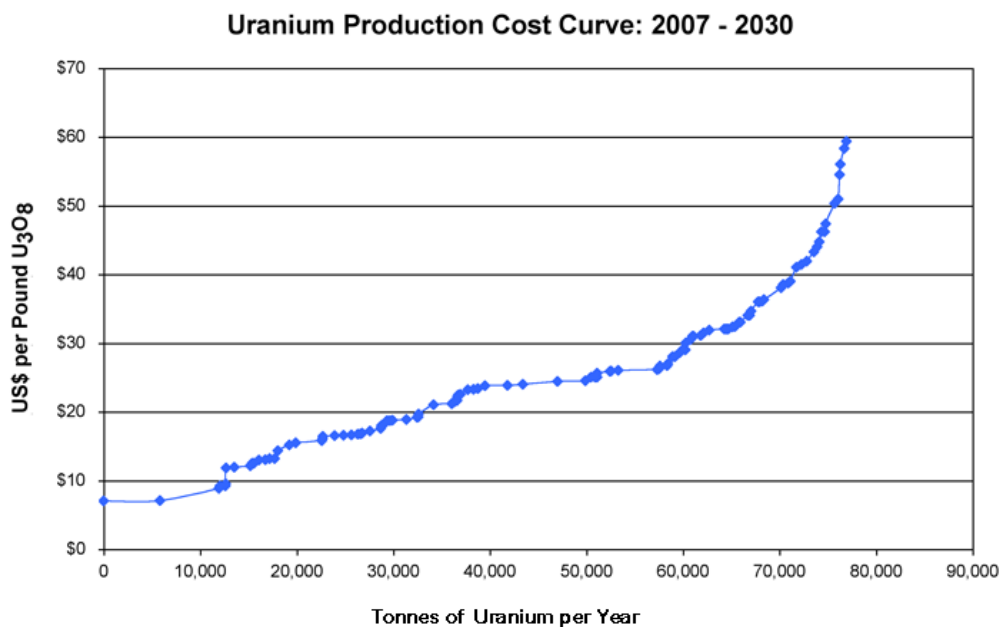
1 t U ≈ 1.179 t U₃O₈ (oxide)

1 kg U₃O₈ ≈ 2.204622 lb U₃O₈

The following graph suggests how these various sources of supply might look in the decades ahead:



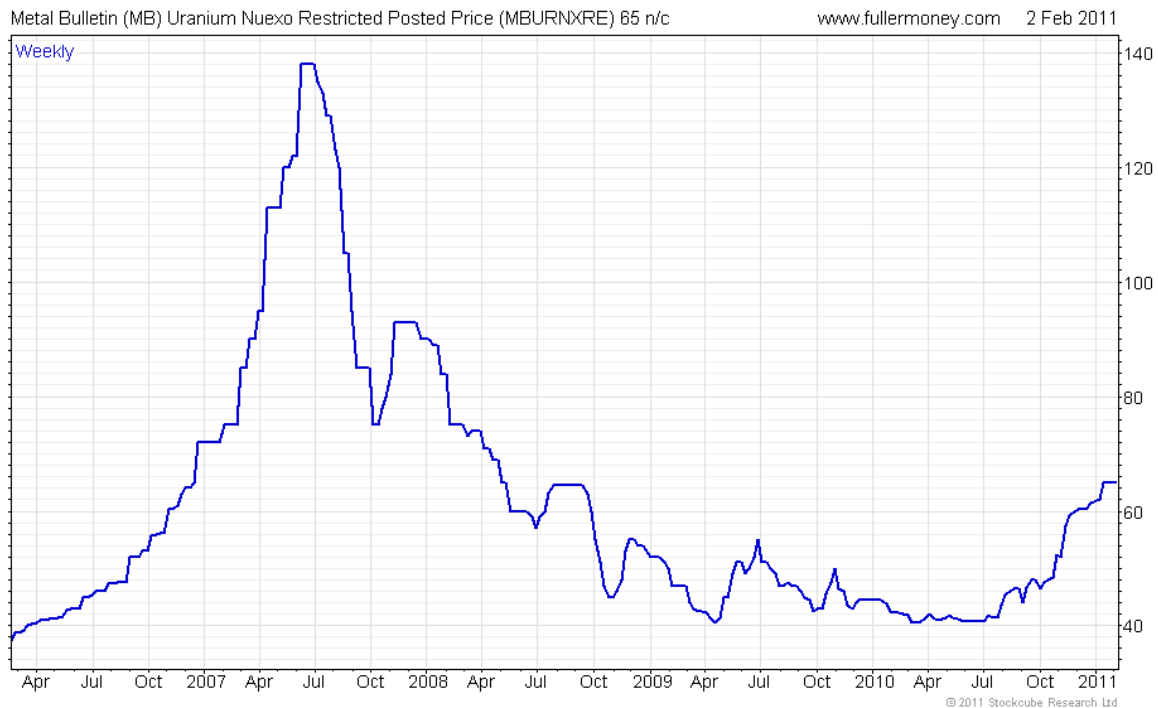
There is no sign of undersupply if the price, like all commodities, is high enough to be economically extracted. The graph below shows the elasticity of price to demand: we are nearing an inflexion point at around 65,000 tU₃O₈ which requires higher market prices to maintain margins. The new START accord signed Saturday February 5 between the USA and Russia aiming at further reducing the nuclear arsenal on both side (the previous one was expiring end of 2013) will also bring additional secondary supply.



4. Uranium price

The perception of imminent scarcity drove the "spot price" for uncontracted sales to over US\$ 100 per pound U₃O₈ in 2007 but it has settled back to \$40-45 over the twelve months to July 2010. Most uranium however is supplied under long term contracts and the prices in new contracts have, in the past, reflected a premium above the spot market.²

The year-end price of \$62.00 per pound U₃O₈ reported by uranium market information specialist TradeTech was the highest value reported since September 2008. At the beginning of 2010 the spot price stood at \$44.50 per pound, and had been declining since 2008 in line with the global financial crisis. It reached an annual low of \$40.50 in March, before prices began to strengthen and the decline was reversed. In November, prices accelerated and the spot price ended the year above \$60 per pound for the first time since August 2008. **From nadir to trough prices collapsed 71% to recover by 80% to Januray 31, still lagging the other commodities complex, albeit slightly.**



USD	CRB index	Uranium	Oil
High	473.97 [Jul-08]	138 [Jun-07]	147.9 [Jul-08]
Low	200.16 [Feb-09]	40.5 [Mar-10]	37.12 [Feb-09]
31-Jan-11	341.42	73	94.28
H to L	-58%	-71%	-75%
L to 31-Jan-11	71%	80%	154%
H to 31-Jan-11	-28%	-47%	-36%

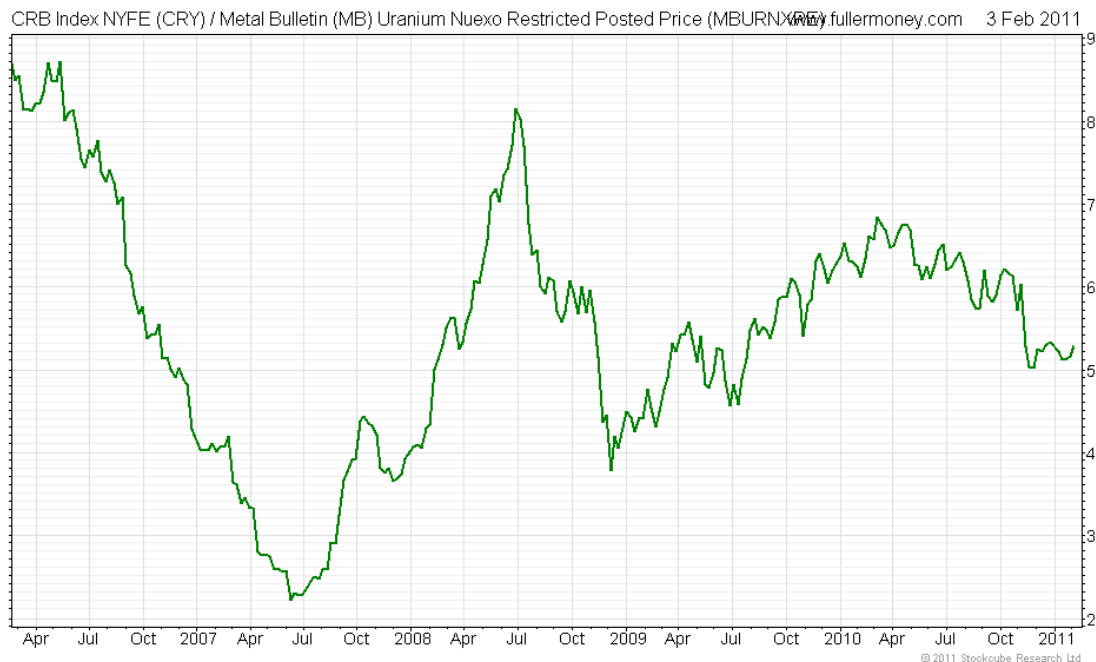
² Note that at the prices which utilities are likely to be paying for current delivery, only one third of the cost of the fuel loaded into a nuclear reactor is the actual ex-mine (or other) supply. The balance is mostly the cost of enrichment and fuel fabrication, with a small element for uranium conversion

As well as an increasing spot price, **2010 also saw record activity on the uranium spot market** with an annual sales volume of 42.8 million pounds. The spot market has **not seen** activity close to this level **since 1990**, when spot market sales reached 40.6 million pounds. Record sales volumes were reported in December, which TradeTech said was due to Chinese nuclear power expansion plans and the signing of two new contracts for long-term uranium supply exciting renewed interest from the financial and investment sectors. The spot price for uranium rose again in January for the eighth consecutive month. Thin spot supplies continue to exert upward pressure on the uranium spot price and TradeTech's Exchange Value is \$72.25 per pound U₃O₈, an increase of \$10.25 from the December 31 Value, 70% higher than a year ago³.

The shift from a buyers' market to a sellers' market that began last year gained new momentum in January. A driving force behind this increase is the ambitious nuclear program in China, along with reports in recent months from several producers that they will not meet production targets.

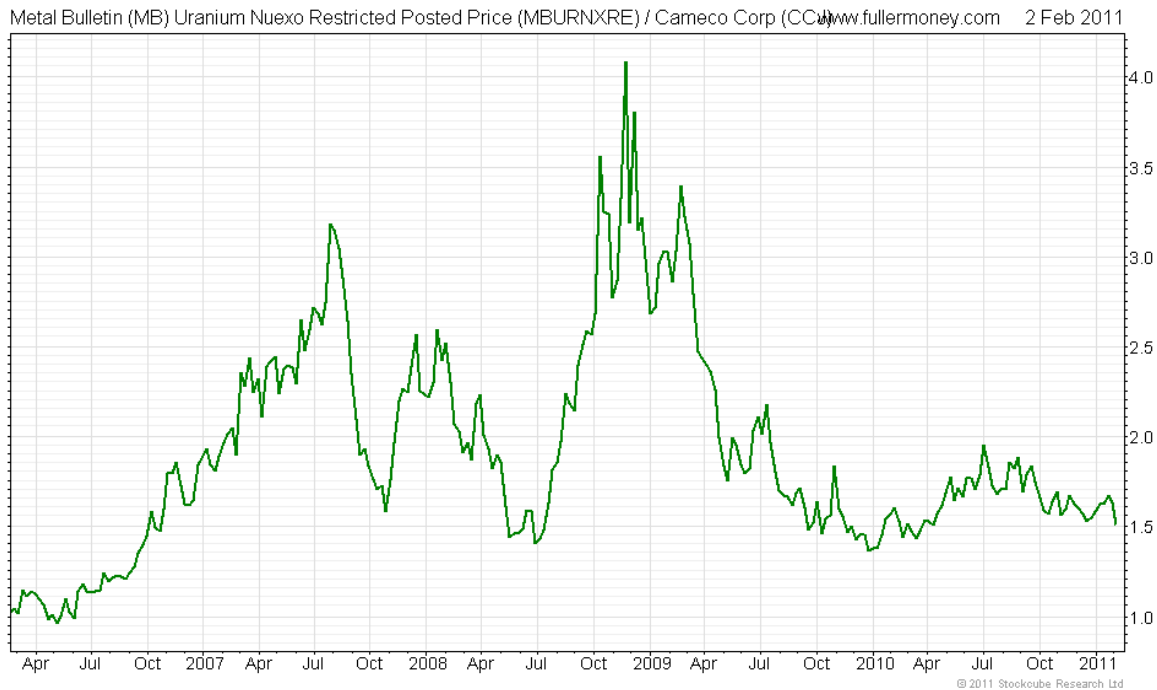
Clearly, the base formation is completed and we have entered a momentum phase.

Uranium tends to substantially outperform and underperform other metals as the graph below shows. Since April 2009, the ratio has moved in a narrow range between 5 and 7, uranium outperforming since April 2010. A very similar pattern applies between oil and uranium.



³ Less than 20% of the world's uranium supplies are traded on the spot market, rather than under long term contracts, but the price in long-term contracts is often related to the spot price at the time of delivery.

If we take Cameco as a proxy for uranium shares and compare it to uranium prices, uranium shares have substantially outperformed during the 2008 financial crisis, and from Q3 2009 both have been moving more or less in synchrony.



5. Uranium shares

Since the early 1990s the uranium production industry has been consolidated by takeovers, mergers and closures. In 2009, **ten companies marketed 89% of the world's uranium mine production:**

Company	tonnes U	%
Areva	8623	17
Cameco	8000	16
Rio Tinto	7963	16
KazAtomProm	7467	15
ARMZ	4624	9
BHP Billiton	2955	6
Navoi	2429	5
Uranium One	1368	3
Paladin	1210	2
GA/Heathgate	583	1
Other	5550	11
Total	50,772	100%

Among these, besides Cameco, all large producers are either integrated mining companies or nuclear companies or are state-owned. In addition, approximately 400 junior mining/exploration companies exist. A few investment vehicles are available to

play the uranium story, but all ETF are encompassing the nuclear industry as a whole and are therefore not limited to uranium mining companies.

<i>Producers (price as of 04/02/11 or 07/02/11)</i>	Cur	Price	High	Low	From high	From low
Cameco	C\$	41.38	59.75	22.14	-30.74%	86.90%
Uranium One	C\$	6.42	17.87	0.6	-64.07%	970.00%
Paladin	A\$	5.9	10.59	1.63	-44.29%	261.96%
ERA	A\$	11.33	28.58	9.35	-60.36%	21.18%
Denison	C\$	3.9	16.57	0.69	-76.46%	465.22%
Uranimu Participation Corp	C\$	9.39	18.67	4.85	-49.71%	93.61%
Powershares Glob Nuc Energy (ETF)	US\$	22.2	29.04	11.47	-23.55%	93.55%
Areva (non-voting shares)	EUR	35.49	83.154	30.51	-57.32%	16.32%

For Areva, investors can only buy non-voting shares, and the company is always subject to French political jittering, but remains the world largest integrated nuclear company.

The fantastic performance displayed by uranium companies has mainly been realized over the past 6 months and a correction is overdue that will provide opportunities to buy.

[Last minute: the correction has started]

Source:

<http://www.iaea.org/>
<http://www.world-nuclear.org>
<http://www.iea.org>
<http://www.worldenergy.org>
<http://www.cea.fr/>
<http://www.uxc.com/>
<http://www.uranium.info/>
<http://www.world-nuclear-news.org>
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