Uranium International Market – ENIN, Recife, Brazil

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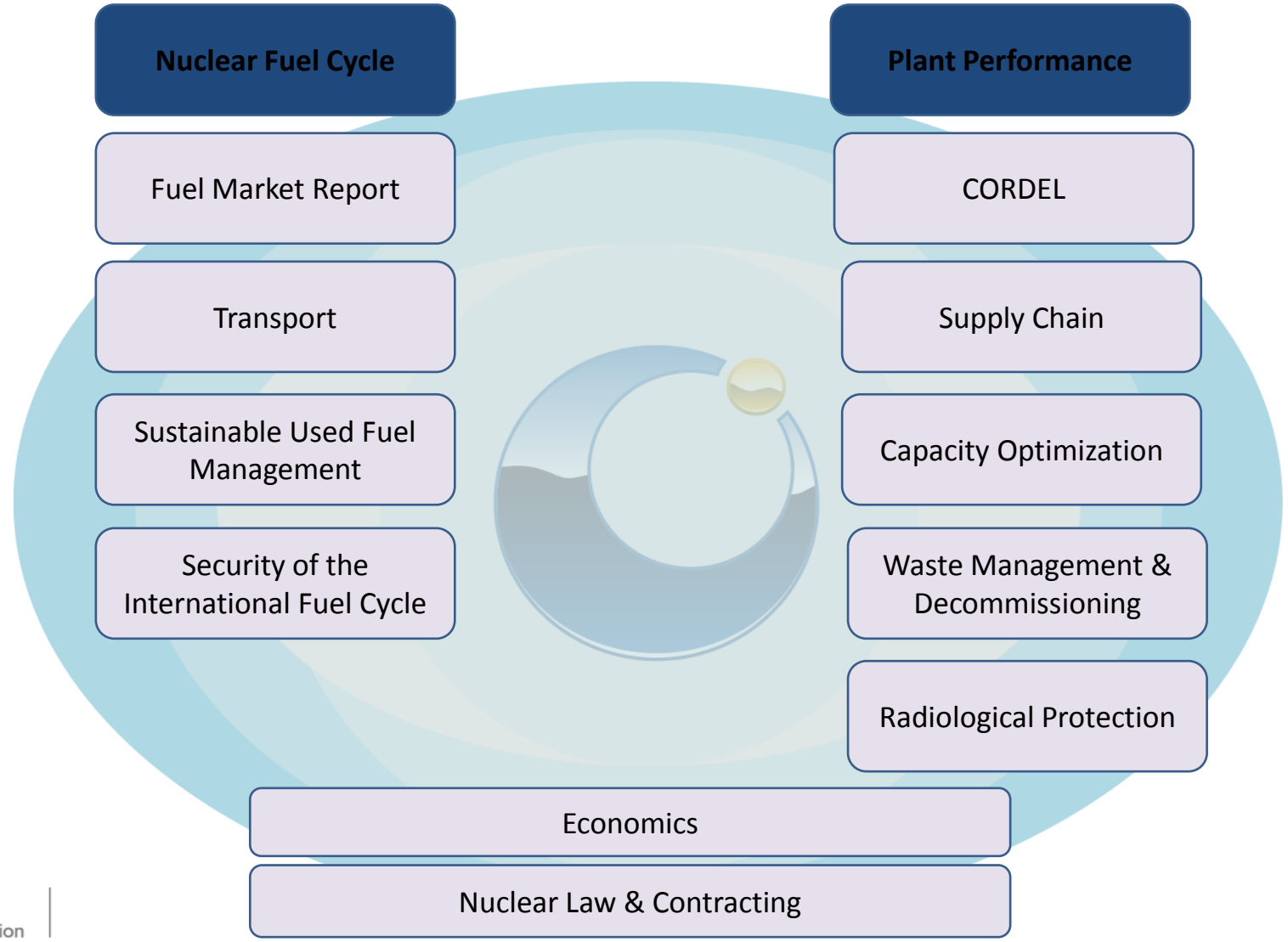
25 November 2013

WNA links with Brazil

About the WNA

WNA Working Groups



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Representation in Key International Forums

International Atomic Energy Agency

Nuclear Energy Agency of the OECD

UN Framework Convention on Climate Change

International Commission on Radiological Protection

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- 200 Information Papers updated regularly
- 14 000 page views per day
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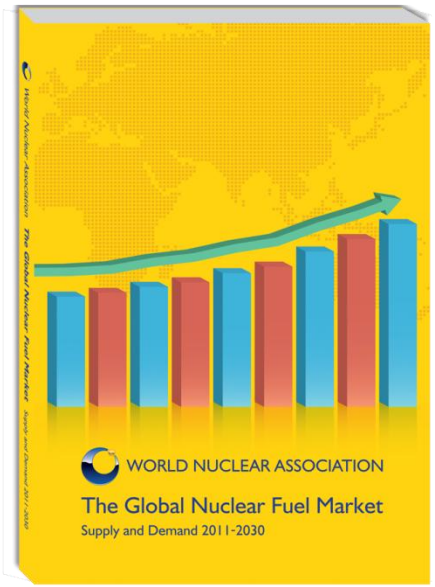
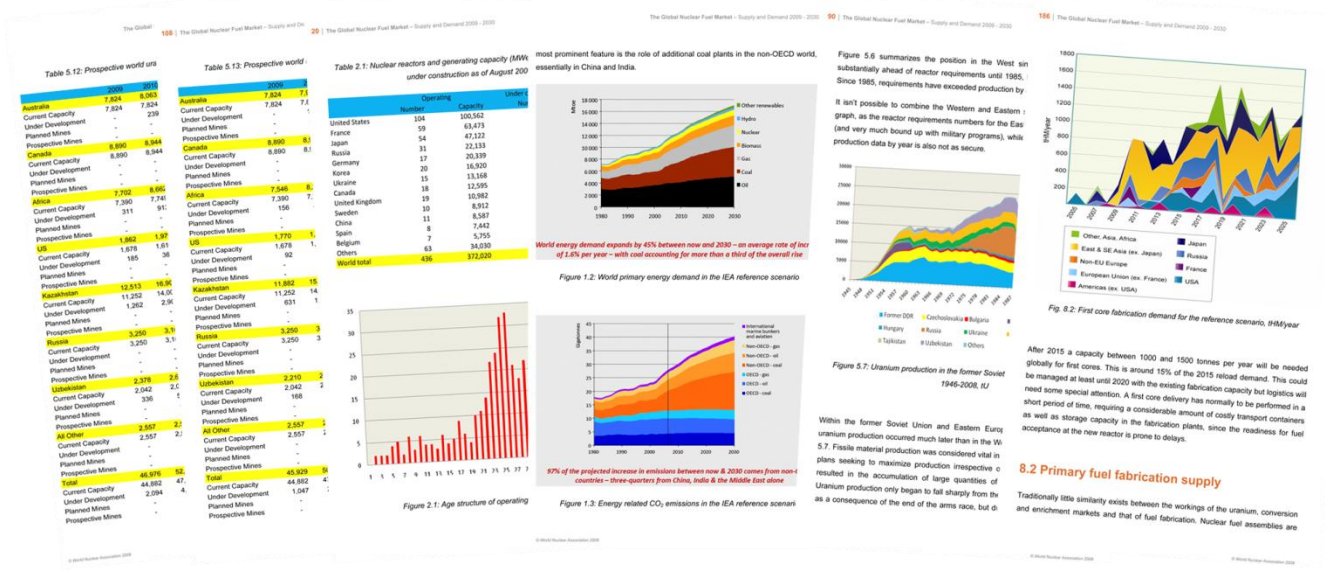
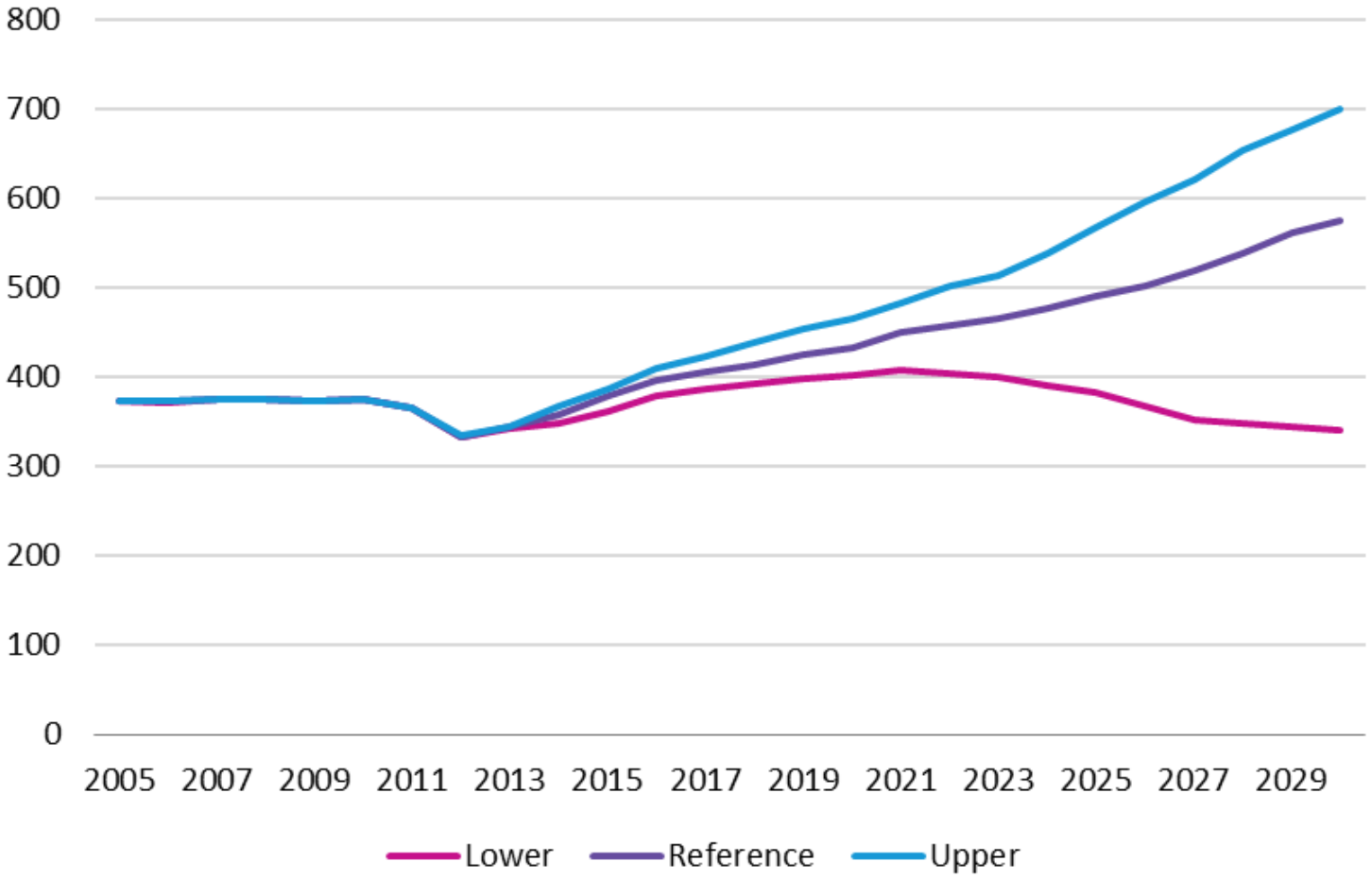
Nuclear Fuel Market & Supply Chain





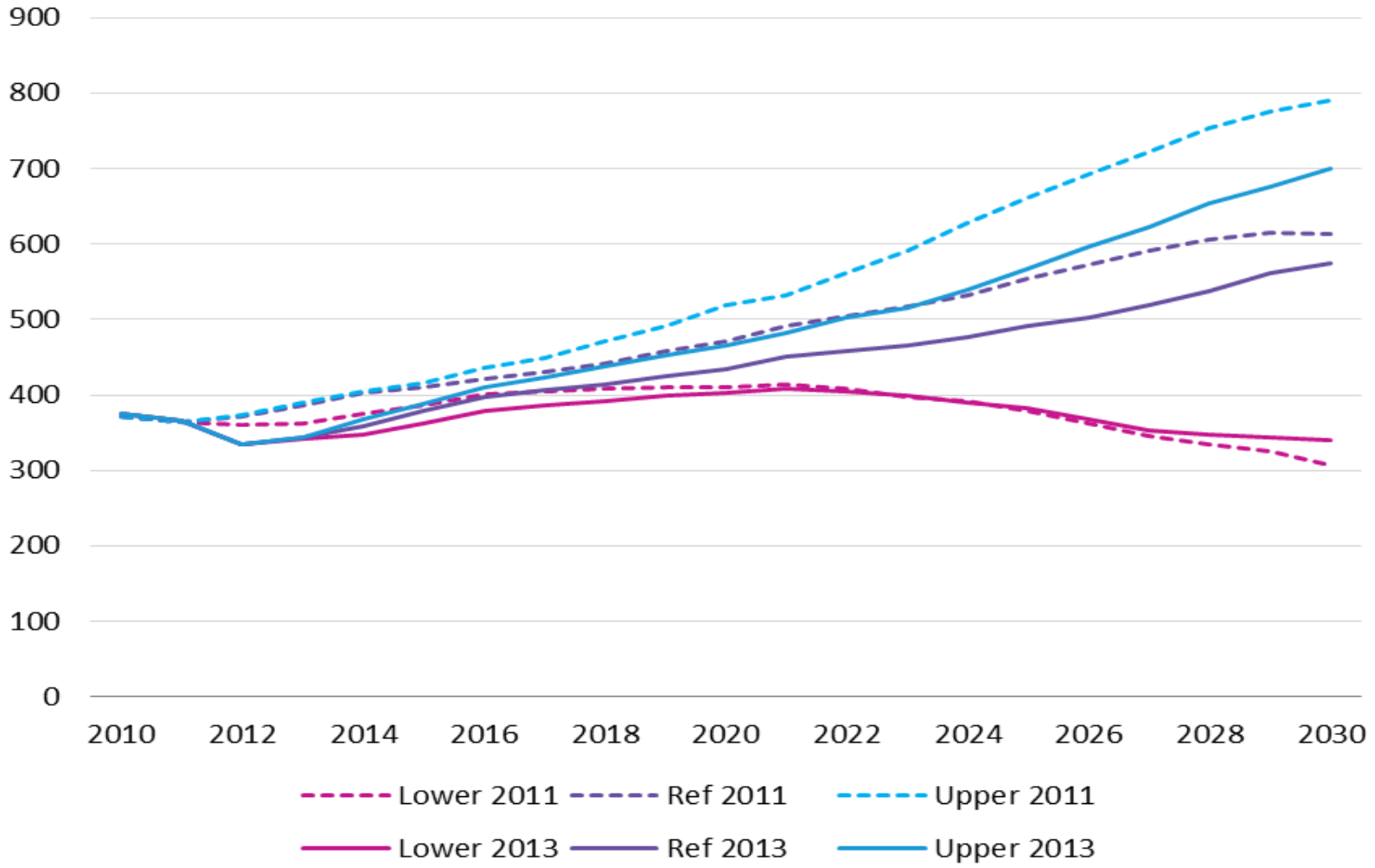
- Biennial market reports on global fuel market and supply chain

World Nuclear Generating Capacity, GWe
(2013 WNA Global Fuel Market Report)



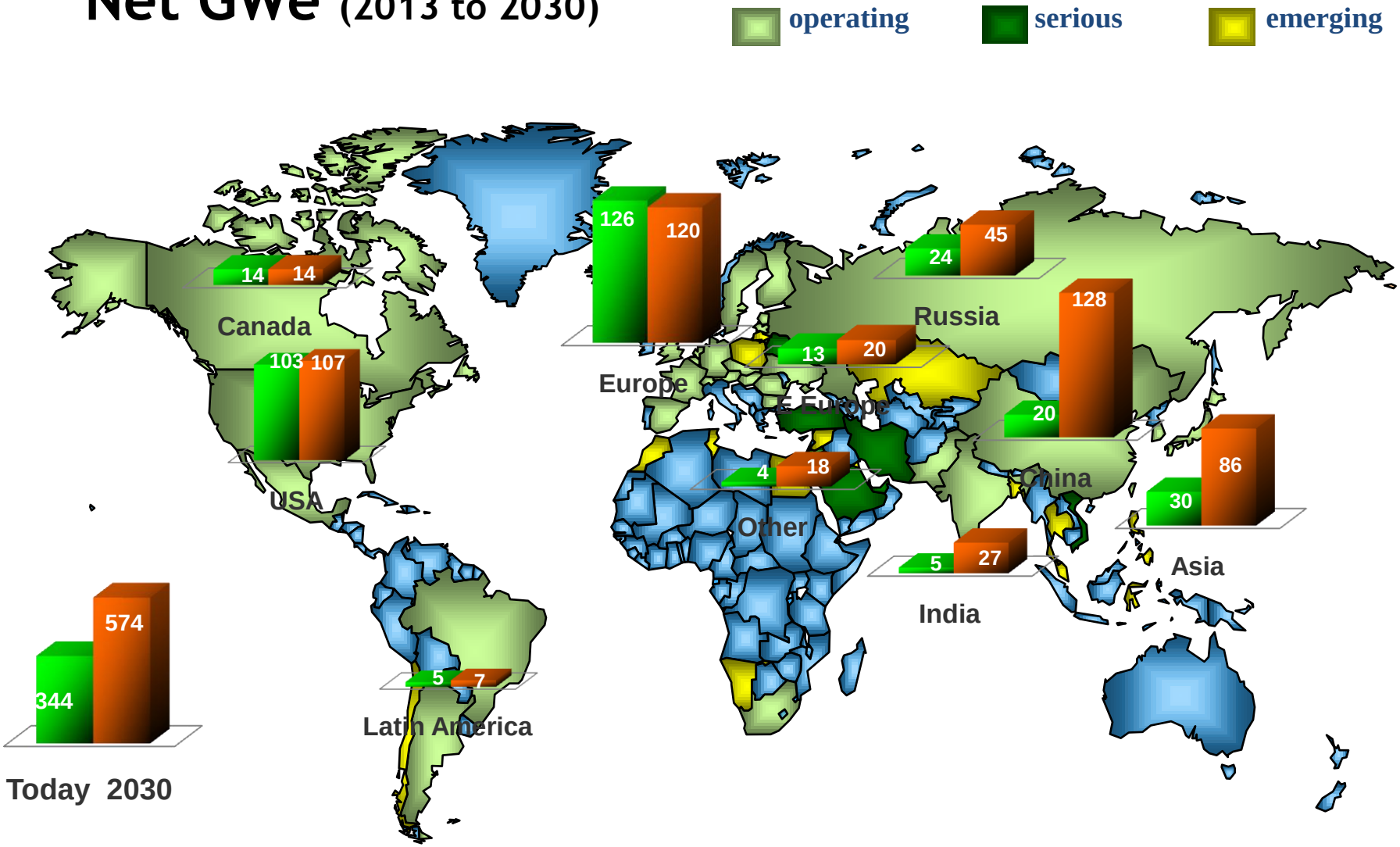
World Nuclear Generating Capacity, GWe

2013 vs 2011 Fuel Market Report



Reference Case Capacity

Net GWe (2013 to 2030)

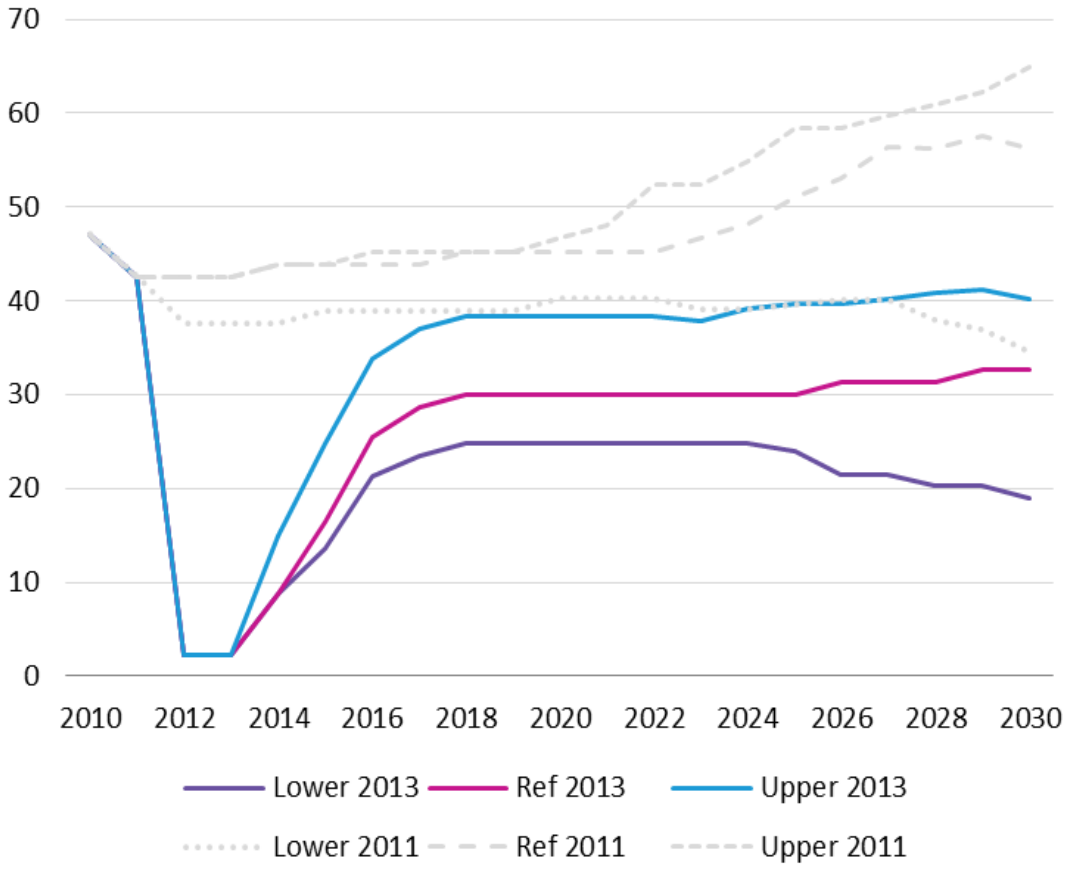


Assessment of Likely Japanese Reactor Restarts

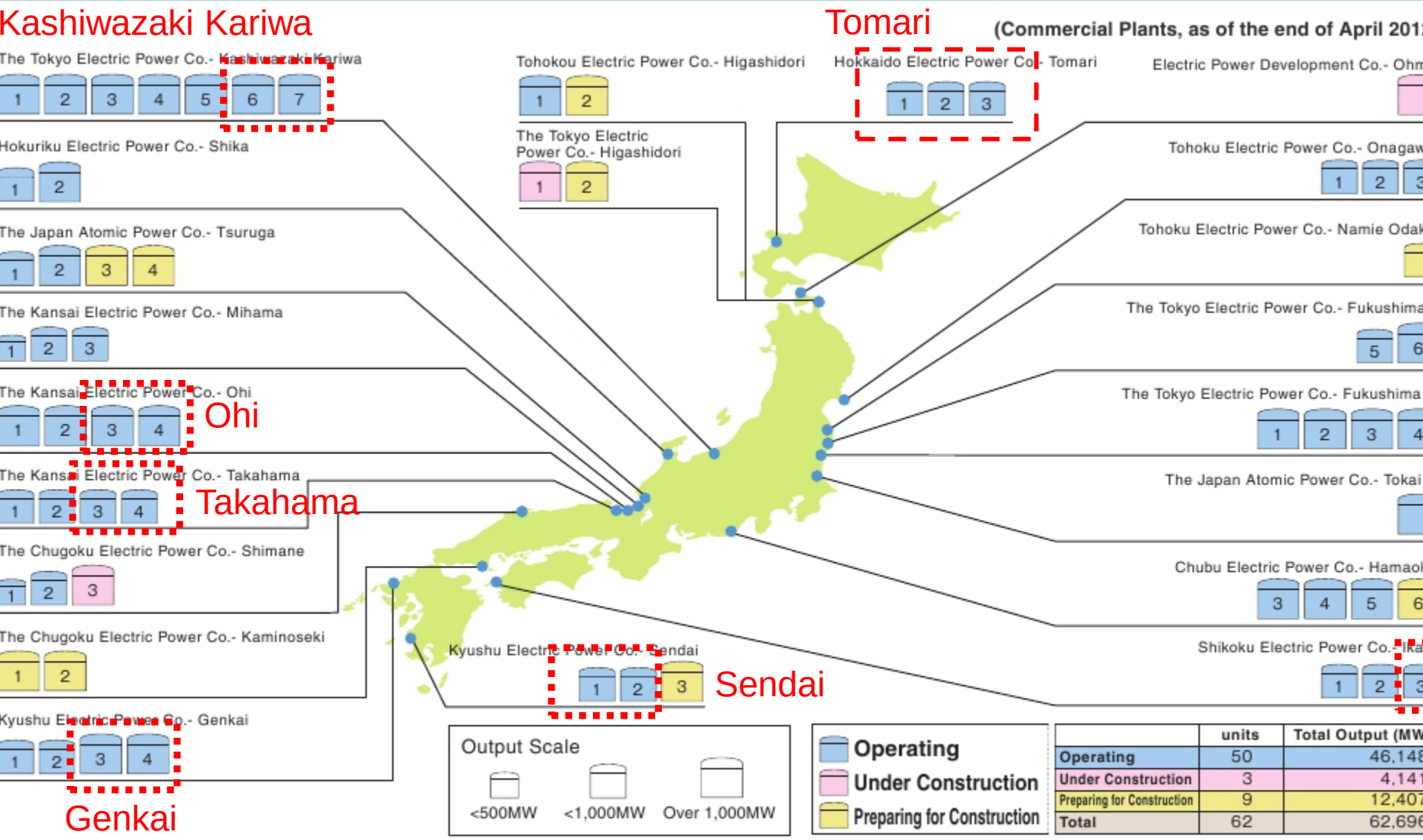
2013 vs 2011 Report

Reactor-by-reactor assessment:

- Age
- Size
- Type
- Location



Nuclear Power Plants in Japan

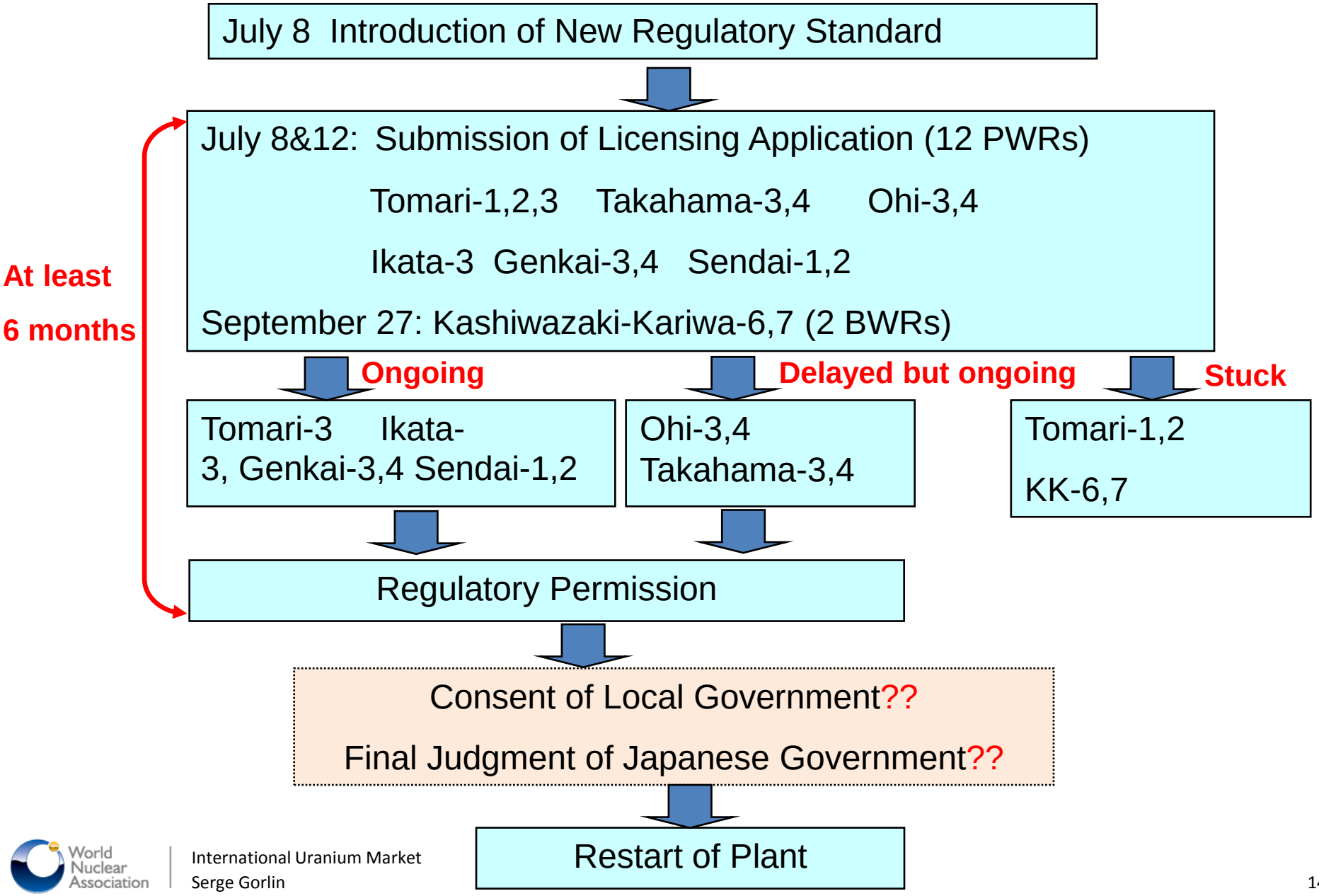


	units	Total Output (MW
Operating	50	46,148
Under Construction	3	4,141
Preparing for Construction	9	12,407
Total	62	62,696

The Tokyo Electric Power Company abolished the unit 1-4 of Fukushima Daiichi Nuclear Power Station on April 19, 2012.
Chubu Electric Power Company abolished the unit 1 and 2 of Hamaoka Nuclear Power Station on January 30, 2009 and is currently decommissioning them.
The Japan Atomic Power Company abolished Tokai Power Station on March 31, 1998 and is currently decommissioning it.

Source: "Operational Status of Nuclear Facilities in Japan (2012)", JapanNuclear Energy Safety Organization (JNES) and oth

Process toward restart



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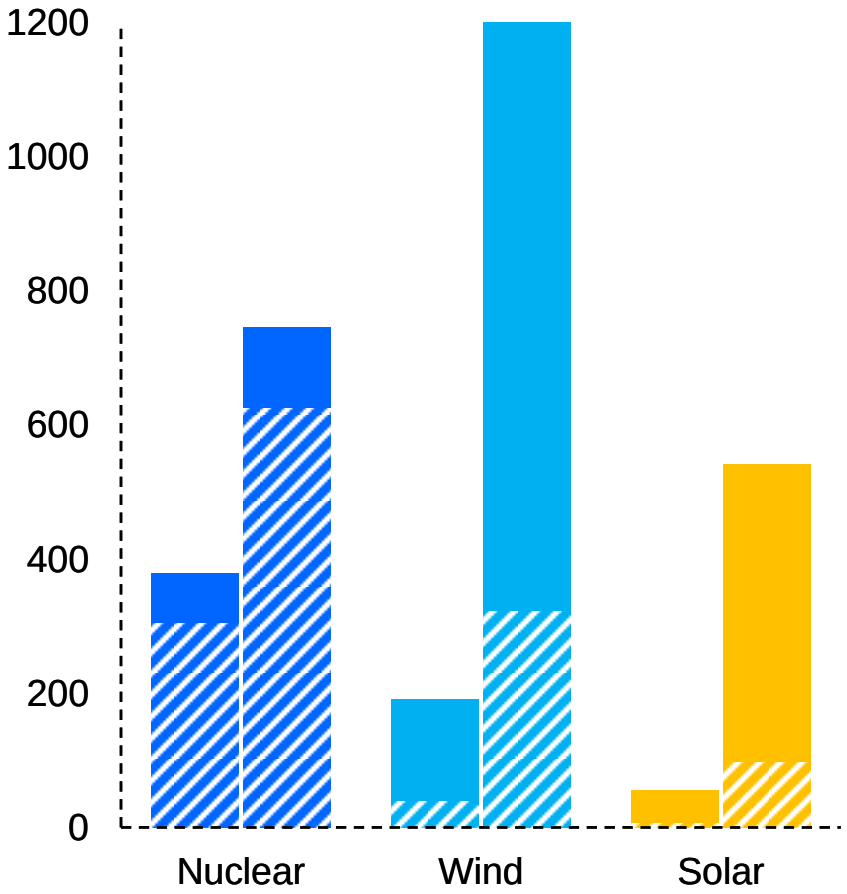
Global Electricity Generation Mix Evolves

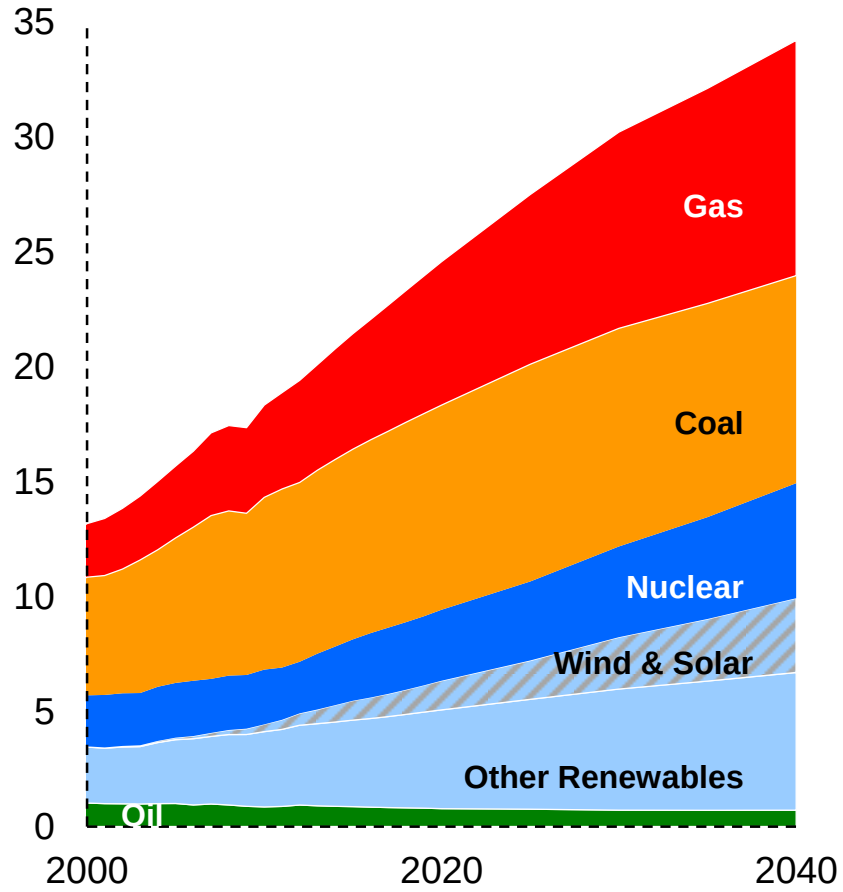
Global Capacity Utilized

GW



By Generation

k TWh



ExxonMobil 2013 Outlook for Energy

Projecting Nuclear Reactor Requirements

- Nuclear generating capacity
- Fuel cycle and reactor operating factors – load/capacity factors, tails assay, fuel burn-up
- MS Excel-based spreadsheet model computes uranium, conversion and enrichment requirements by year to 2030

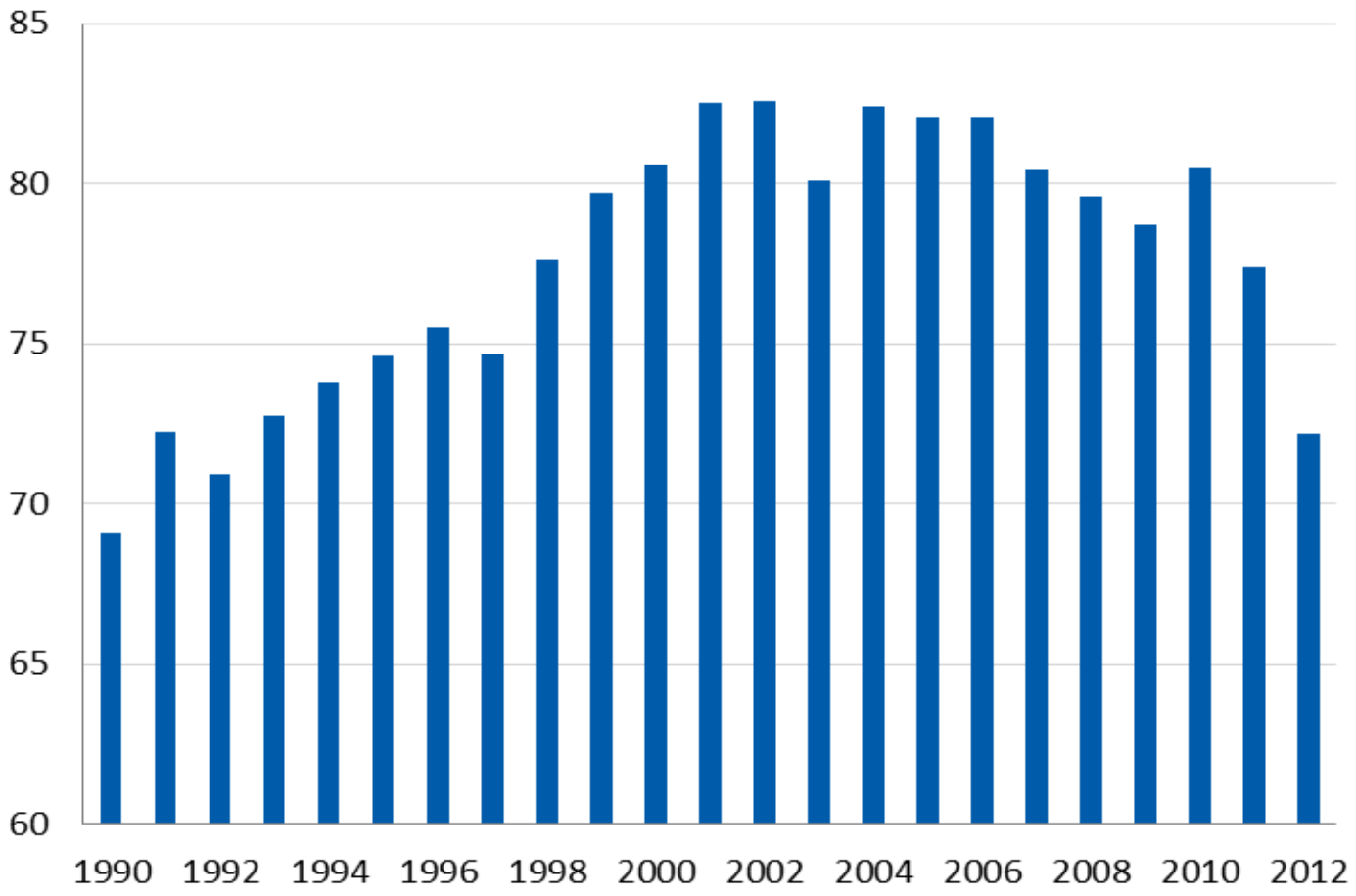
Sensitivity of Factors

Table 3.2: Impact on uranium and SWU demand from parameter changes

Parameter	Base value	Change	Impact on U	Impact on SWU
Capacity factor	80%	5%	6%	6%
		-5%	-6%	-6%
Tails assay	0.25%	0.03%	6%	-6%
		-0.03%	-6%	6%
	0.15%	0.05%	8%	-13%
		-0.05%	-7%	18%
Burn up	40 GWd/tU	5	-3%	1%
Reactor power level increase	present	10%	12%	12%
		-10%	-15%	-15%

0.22% 2013 Market Report

Global Load Factors
(using IAEA capacities)



Recent Uranium Production, tU

Global production increased by a third 2008-2012

Mines that have opened since 2011 include:

- Honeymoon (Australia)
- Langer Heinrich Stage 3 (Namibia)
- Novokonstantinovskoe (Ukraine)
- Willow Creek (US)

Ramp-up of existing mines continues, led by Kazakhstan (nearly 2ktU increased production 2011-2012)

Country	2010	2011	2012	% change 2010-2012
Australia	5,900	5,983	6,991	18%
Brazil	148	265	231	56%
Canada	9,783	9,145	8,998	-8%
China	827	885	1,500	81%
India	400	400	385	-4%
Kazakhstan	17,803	19,451	21,317	20%
Malawi	846	1,077	1,101	30%
Namibia	4,496	3,258	4,495	0%
Niger	4,198	4,351	4,667	11%
Russia	3,562	2,993	2,872	-19%
South Africa	583	582	465	-20%
Ukraine	850	890	960	13%
United States	1,660	1,537	1,596	-4%
Uzbekistan	2,400	2,500	2,400	0%
Others	207	178	366	77%
Total	53,663	53,494	58,344	9%

Potential production capacities

Four categories of potential production capacities:

More based on publically available statements

Mines under development (mines for which development decisions have been made and development spending has commenced)

Planned Mines (mines for which a feasibility study has been completed, regulatory process and project financing are advanced, with a definite start-up date)

Prospective Mines (projects which have undergone preliminary feasibility study, regulatory approvals initiated and indicative start-up announced)

Supply Pipeline (uncategorised supply to meet future demand, eg, development of early stage projects, resurrection of cancelled or deferred projects, unexpected mine life extensions at existing operations)

Production model discount and delay factors

Three supply scenarios are developed and production capabilities are projected. Production capability for each mine assumes an expected percentage level of the production capacity as well as a 'delay' (in years) to start-up

	Reference		Upper		Lower	
	Delay	% Expected	Delay	% Expected	Delay	% Expected
Current Capacity*	0	90%	0	100%	0	85%
Mines Under Development	-2	90%	-1	90%	-2	70%
Planned Mines	-6	80%	-5	90%	-6	70%
Prospective Mines	-8	70%	-7	90%	-8	60%

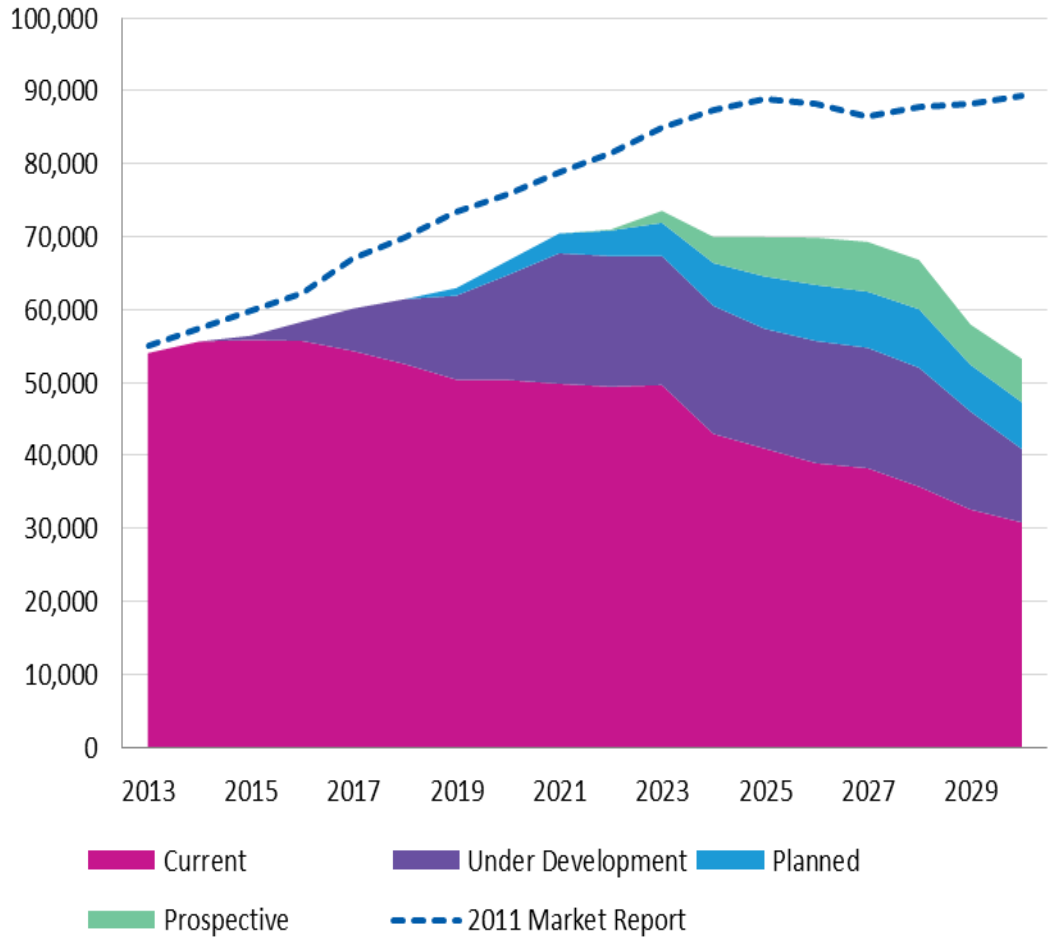
Reference Scenario Primary Supply to 2030, tU

Compared with the 2011 report, expected primary supply has been significantly revised.

Capacity definitions are now more based on public statements. Many projects have been transferred to the Supply Pipeline category.

Existing capacity incorporates published statements of expected 2030 production (down approx. 20ktU vs 2011 report)

Planned and prospective capacity changes reflect project cancellations/deferments (eg, Olympic Dam, Trekkopje) (down approx. 15ktU in 2030 vs 2011 report)

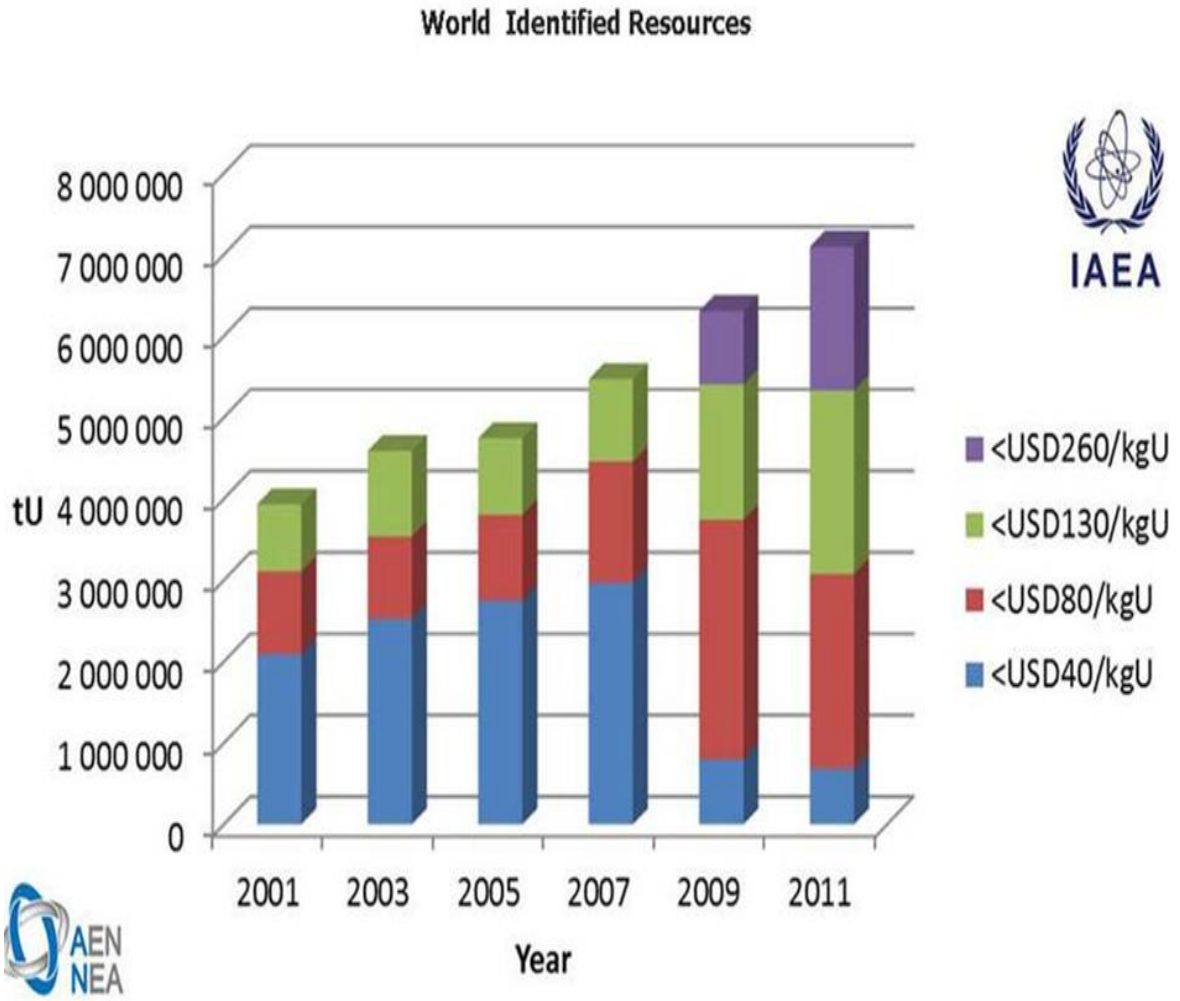


Conclusions

- WNA nuclear capacity projections have been revised downwards since the 2011 report. Nuclear capacity is still projected to increase at a faster rate than anytime since the 1980s to 574GW by 2030 in the reference scenario leading to projected uranium requirements of 97,000tU.
- Increased uranium market uncertainty has resulted in the cancellation and deferment of a number of mining projects. As a result, existing and expected capacity plus secondary supply will be insufficient on current plans to meet reference scenario requirements by about 2023.

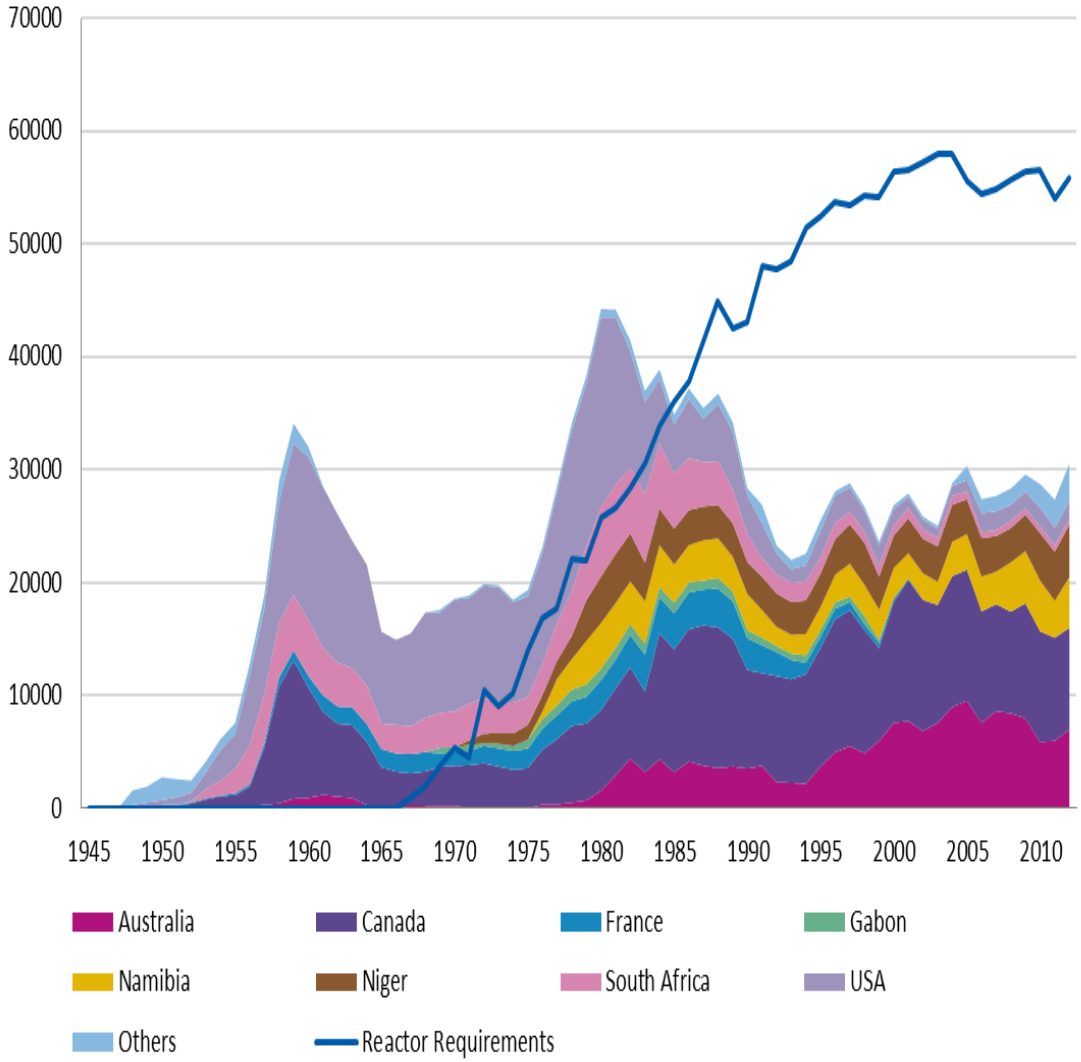
World Uranium Resources

- The amount of identified resources in the Red Book continues to increase rapidly
- The overall cost of mining these resources has increased
- Most of these resources are found in four countries (Australia, Kazakhstan, Russia, Canada)



Historical Uranium Production – Western World

Production was substantially ahead of reactor requirements until 1985, but has since fallen below. Since 1985, requirements have exceeded production by over 450,000 tU. The difference was covered by inventories and other secondary sources



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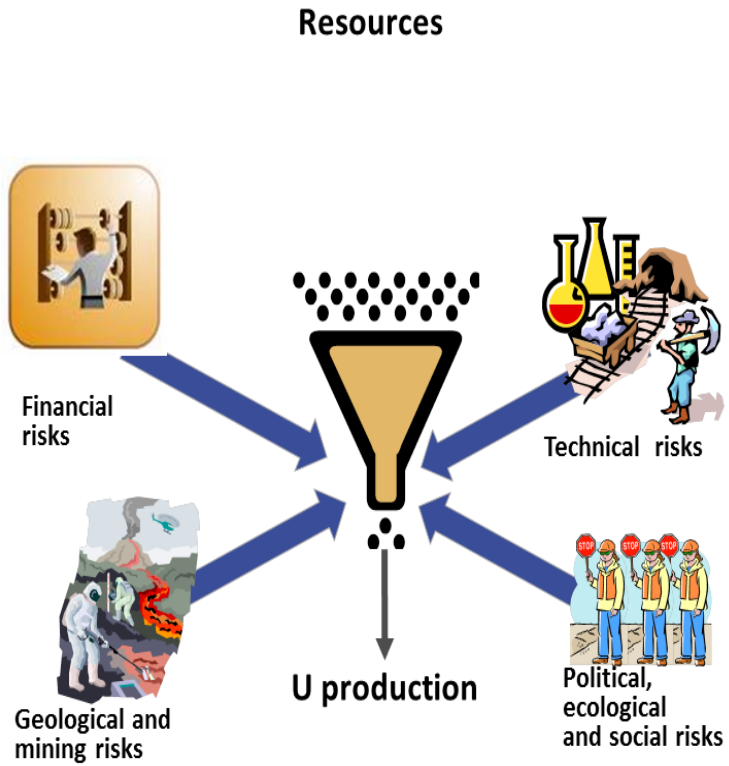
Mining is a risky business!



Main risks hampering the development of the biggest U mining projects

Deposit	Financial risks	Technical risks	Political social and environmental risks
Olympic Dam (expansion),	V		V
Cigar Lake	V	V	
Imouraren	V		V
Midwest	V		V
Jabiluka			V
Elkon	V		

Fuel Cycle & Reactor Operating Factors

- Load factors – 10% worldwide increase in 1990s but now stable
- Enrichment level – rising slowly – up to 5% U-235
- Fuel burn-up – now rising above 50 GWd/tU
- Tails assay – possible substitution between uranium and enrichment depending on relative prices

Reactor Construction Performance

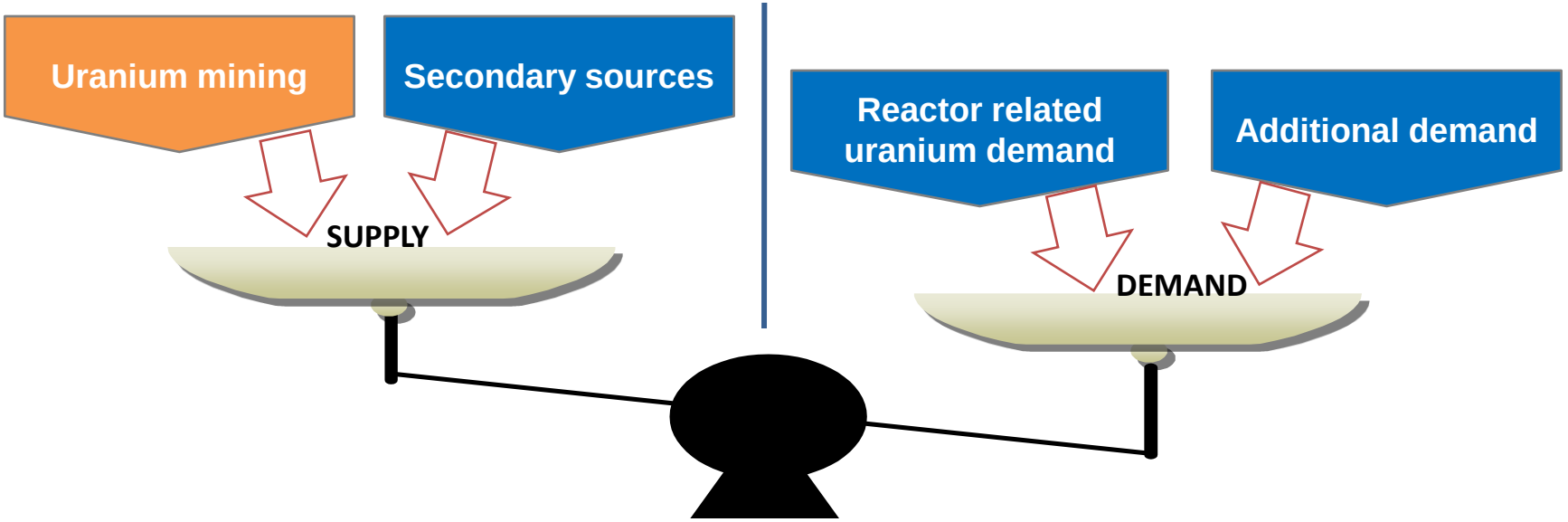
Annex 2: Reactor Construction Times 2003-2013

Construction Times (in years) *Startups between 2003 and July 2013*				
Country	**Units**	**Mean Time**	**Min**	**Max**
China	11	5.9	4.4	11.2
India	6	6.7	5.1	8.8
S. Korea	5	4.4	4.0	5.3
Japan	4	4.4	3.8	5.1
Russia	3	23.8	19.2	26.8
Ukraine	2	18.8	18.2	19.5
Iran	1	36.3	36.3	36.3
Pakistan	1	5.3	5.3	5.3
Romania	1	24.1	24.1	24.1
Total	**34**	**9.4**	**3.8**	**26.8**

Sources: IAEA-PRIS, MSC, 2013

Percentage Variation in U & SWU Requirements with Tails Assay

Uranium supply – demand sources



Main factors of demand/supply relationship

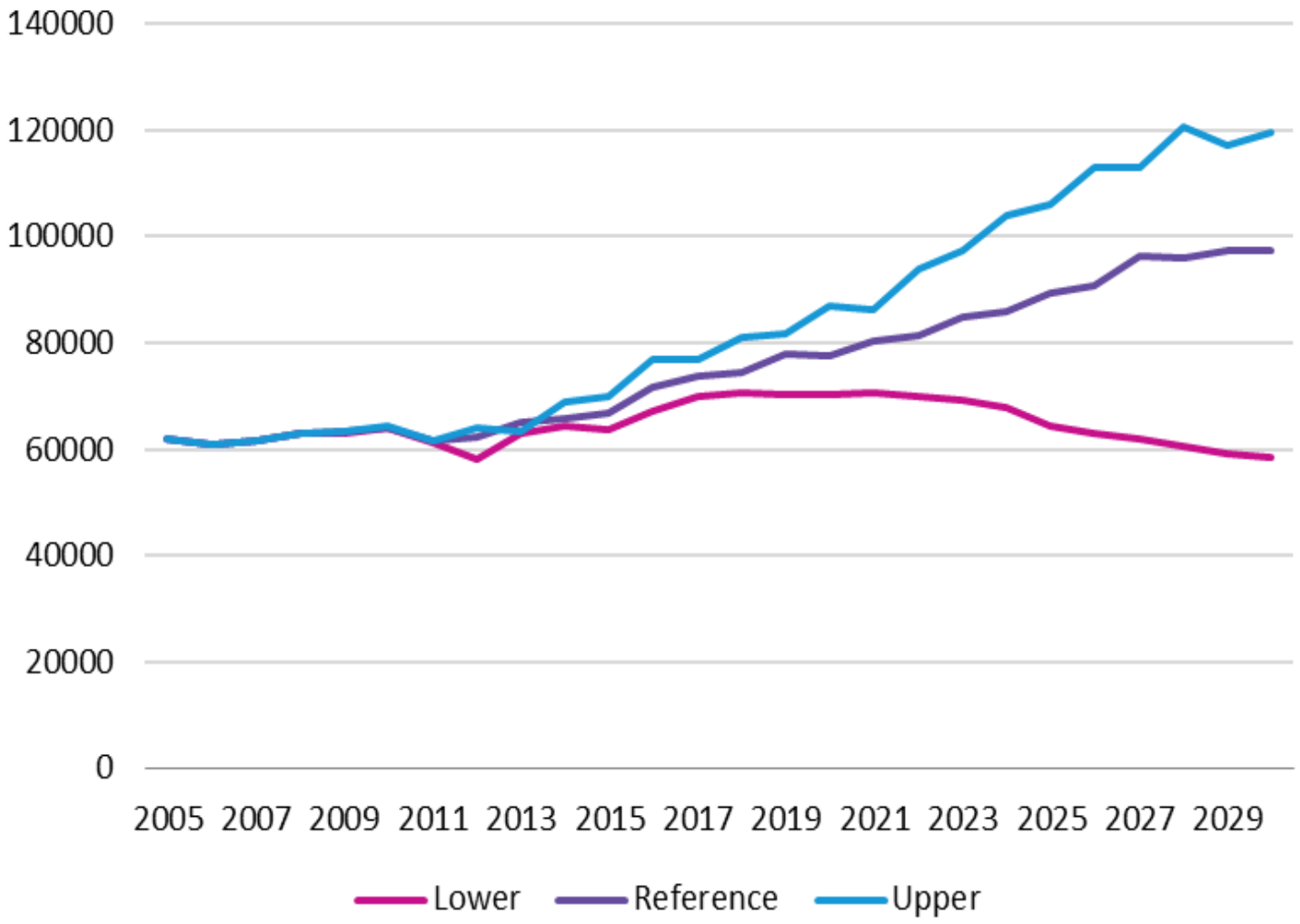
- Favorable uranium prices
- Sufficient and qualitative uranium resources
- Uranium production capacities

- HEU-LEU Program
- US policy in the uranium inventory reduction and stock balance selling
- Policy in depleted U, spent fuel and HEU reprocessing

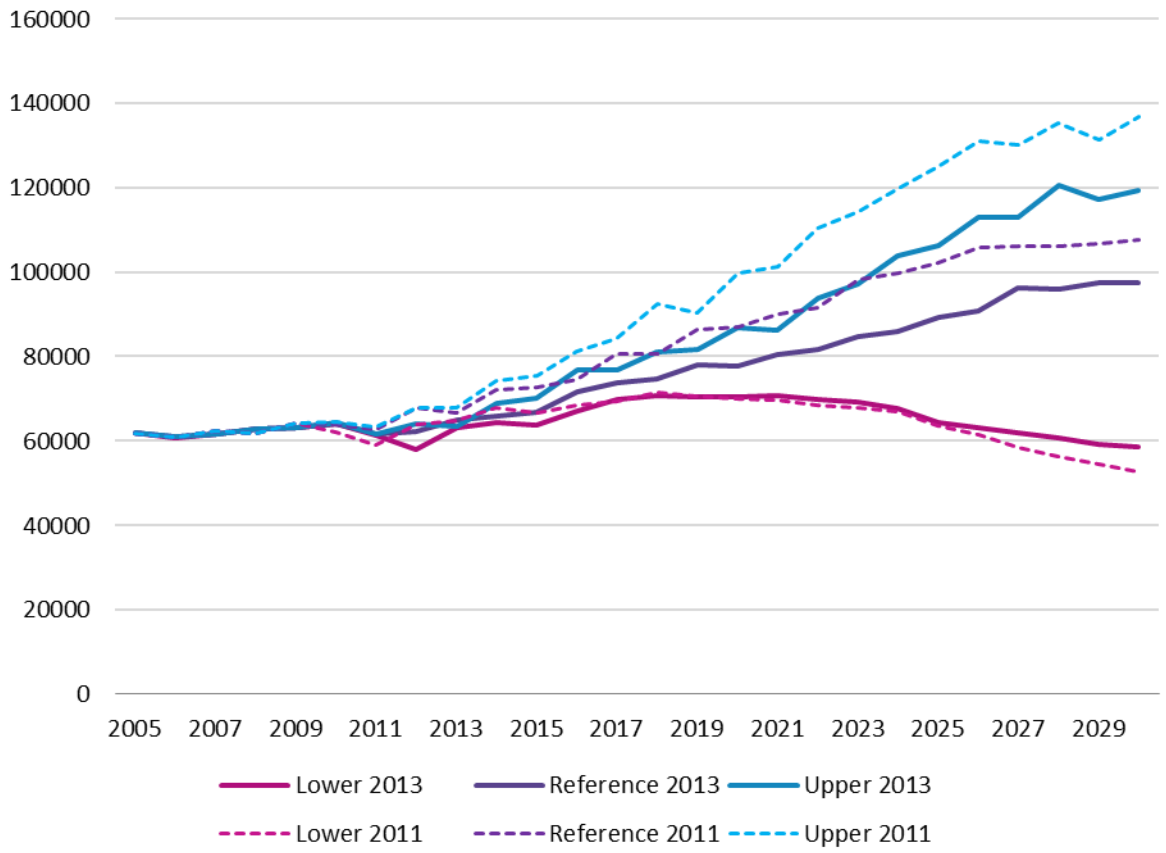
- Capacities
- Selection of tails assay
- Load factors
- Extending cycle length and enrichment levels
- Increased burn up

- Uranium as a trading commodity (stocks trading)
- Inventory change

World Uranium Requirements, tU (2013)



World Uranium Requirements, tU 2013 vs 2011 Reports



Tails Assay

Essentially an economic decision – relative price of U and SWU

- 0.30%-0.35% until 2003-4, now below 0.25%
- 2013 Market Report - 0.22% for all reactors

China's resourcing of uranium

Background

- Demand for uranium will increase sharply after 2020.
- Domestic production capability is limited. (~1500tU per year)

Government's Guideline- Three "1/3"s

- 1/3 of demand to be satisfied by domestic production;
- 1/3 of demand to be satisfied by purchasing natural uranium globally;
- 1/3 of demand to be satisfied by acquiring overseas resource asset.

Source: CGNPC