

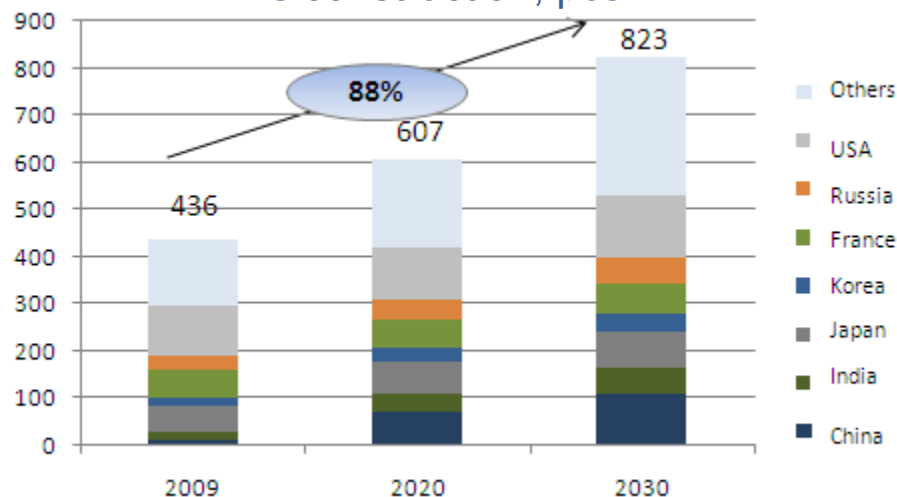


# Sustainable Development of U Production: Time Challenge

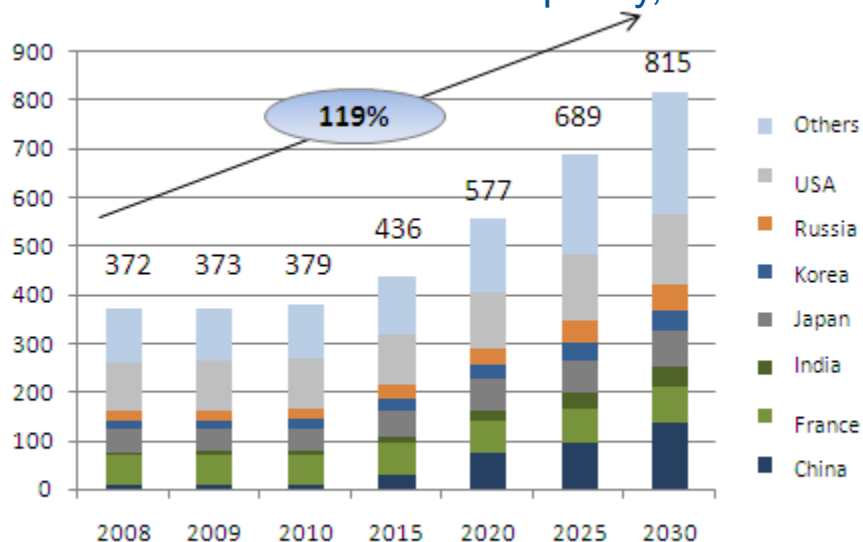
**Alexander V. Boytsov**  
Deputy Director General,  
ARMZ Uranium Holding

**Moscow, 2010**

NPP's construction, pcs.



NPP's installed capacity, GWe



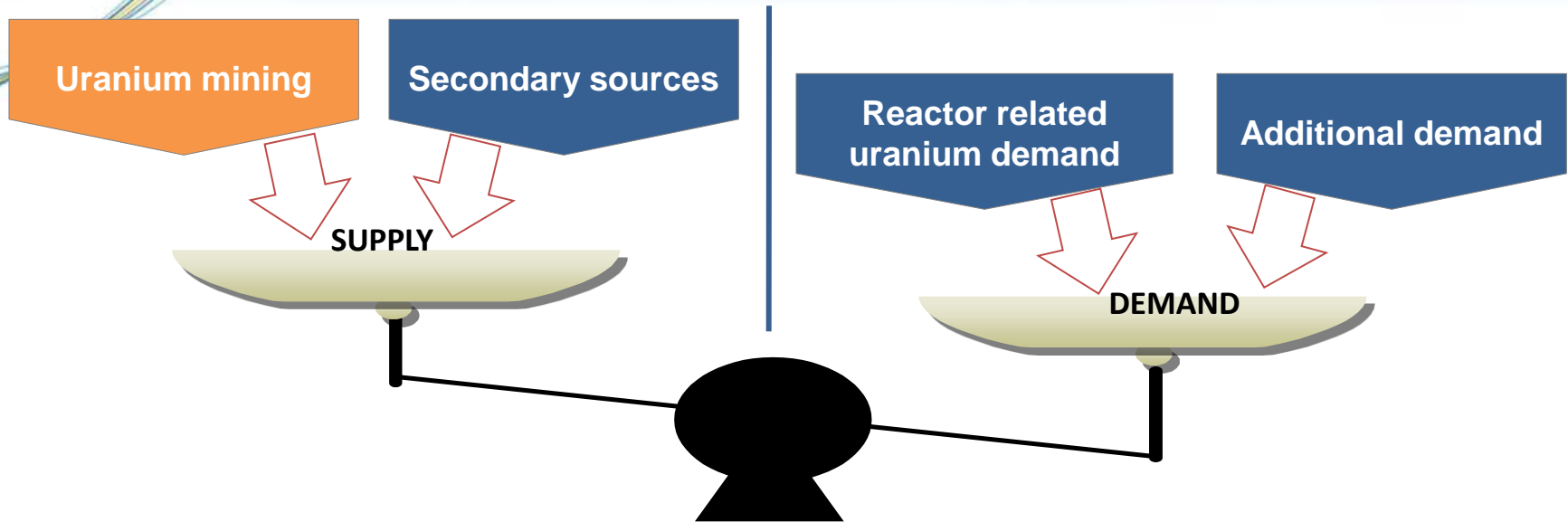
Today

- ❑ 436 operating Nuclear Power Reactors with a installed capacity of 372 GWe.
- ❑ Most of operating NPPs are located in the USA (104), France (59), Japan (53) and Russia (31).
- ❑ 49 new reactors with a combined installed capacity of 44.35 GWe are under construction in 13 countries.

In a 20 years:

- ❑ 88 % growth of operating NPPs worldwide.
- ❑ 119% growth of total installed nuclear capacity.
- ❑ Most active nuclear industry development - in China and India.
- ❑ 2,5-fold grow of installed NPP's capacity in Russia.

# Uranium demand and atomic energy growth



## The main factors of demand/supply relationship

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

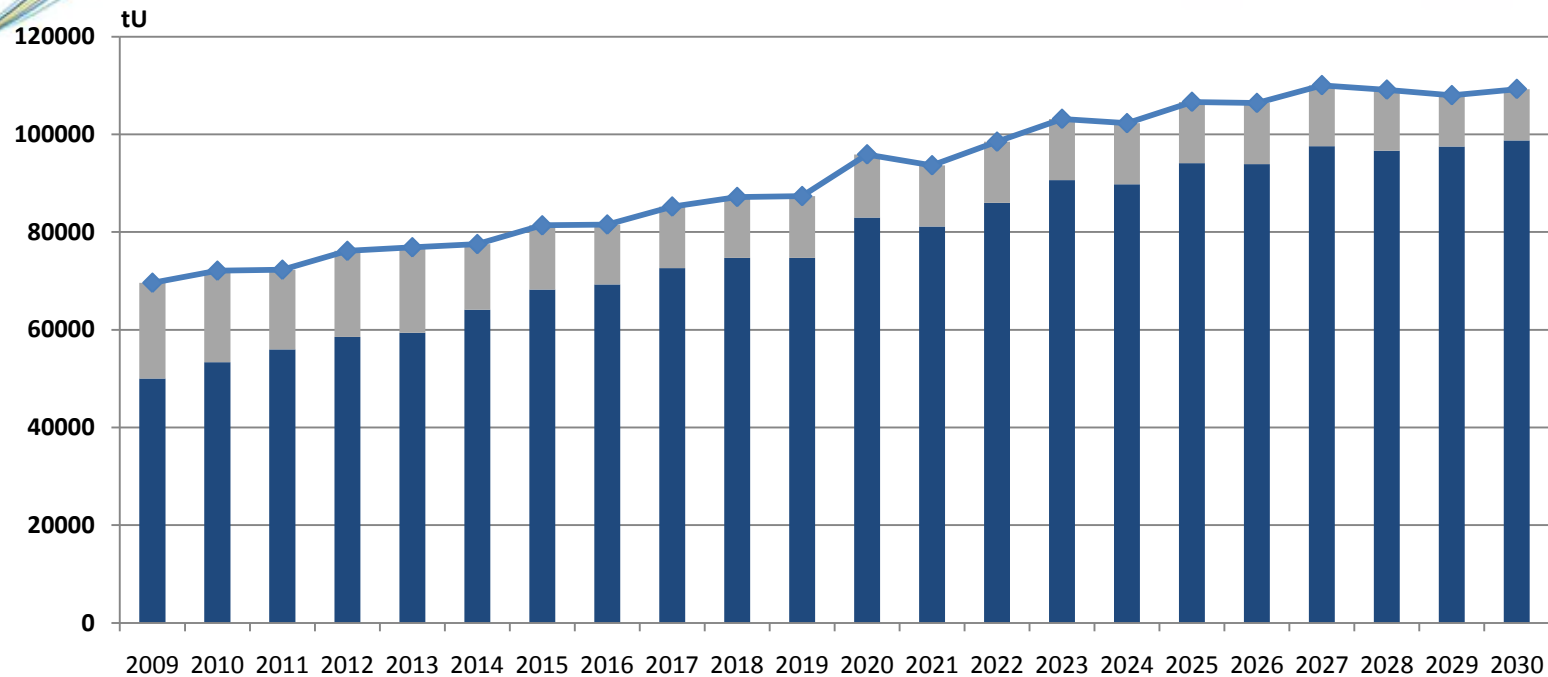
- HEU-LEU Program
- US policy in the uranium inventory reduction and stock balance selling
- Policy in spent fuel and HEU recycling

- Countries' policy in atomic energy
- Trends in new NPPs construction
- NPP's operation time extension
- NPPs decommissioning

- Uranium as a trading commodity (stocks trading)
- Energy companies stockpiles

**Key issue of the atomic energy development – sustainable and long-term uranium supply**

# Projected U requirements to 2030



WNA 2009, reference scenario

Additional demand (inventories, investors, hedge funds) – 5% of plant requirements

■ U production

■ Secondary sources

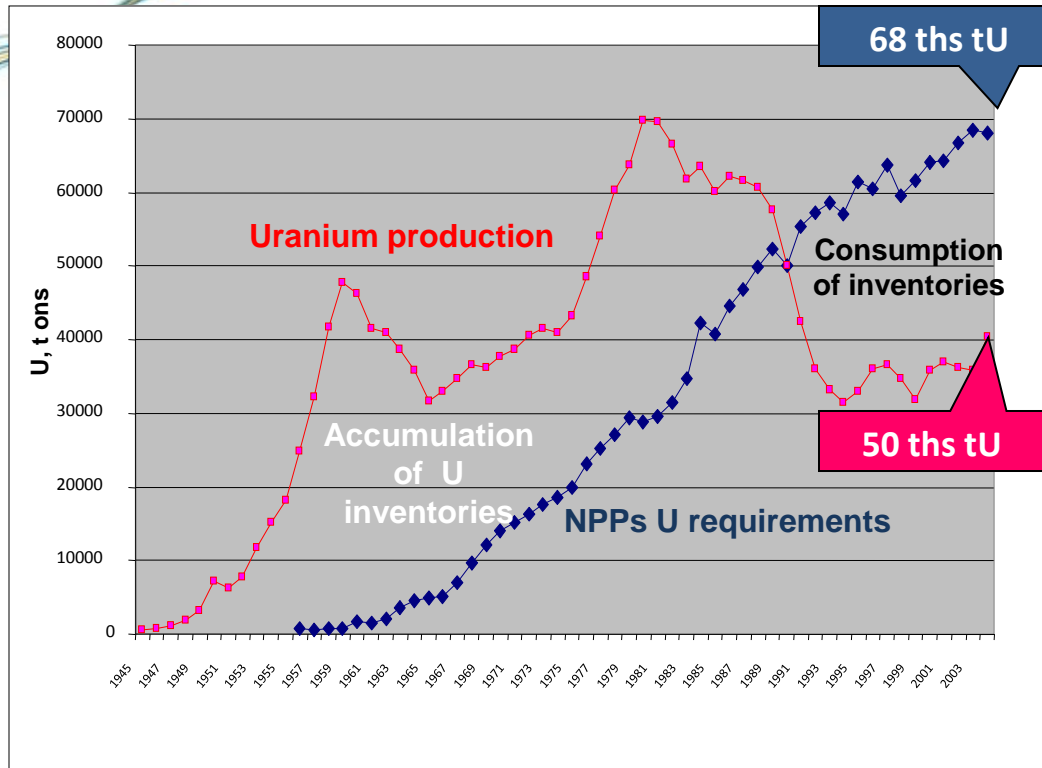
◆ Total U requirements

WNA 2009 Nuclear Fuel Market Report:  
Reactors requirements growth from 68,000 to 104,000 tU to 2030 (53%)  
Uranium production needs to increase from 50,000 to 99,000 tU

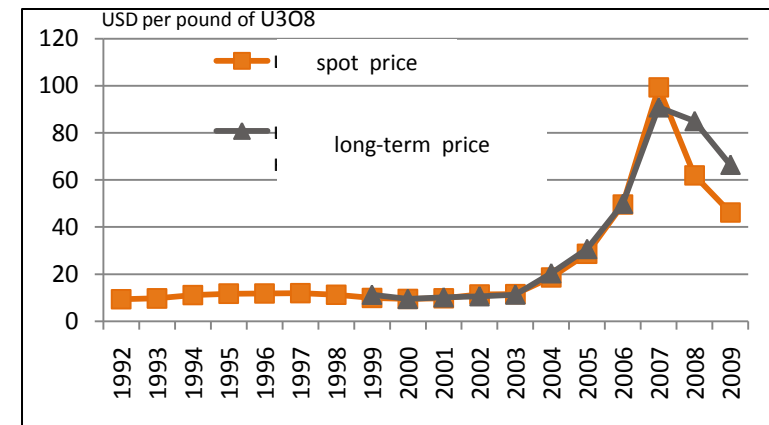
**Is it possible for U industry to double uranium production within 20 years?**



# Historical uranium production vs NPPs demand

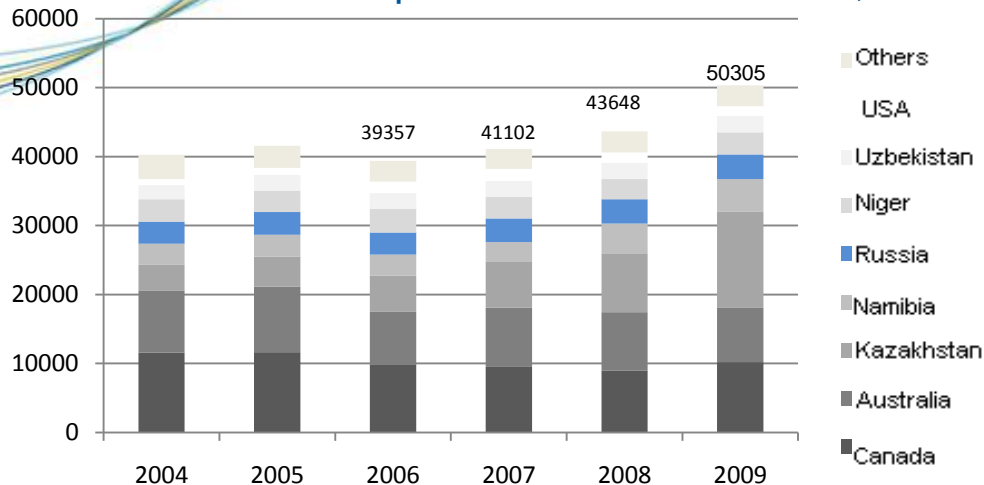


Since 1945	Ths. tU
Produced	2 468
Consumed	1 919
Stockpiled	549



The last 20 years – uranium production covered about 40% of uranium demand.  
 The difference was covered by inventories and secondary sources.  
 Low uranium prices did not stimulate uranium production

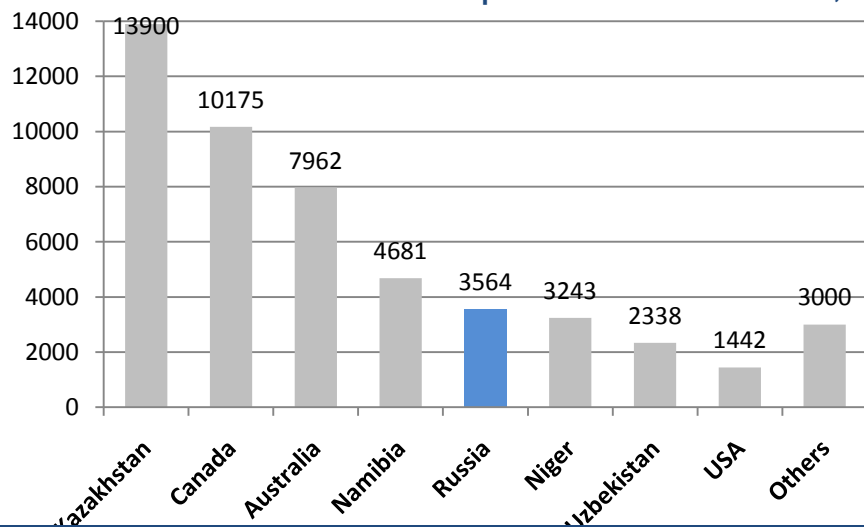
## World uranium production in 2004-2009, tU



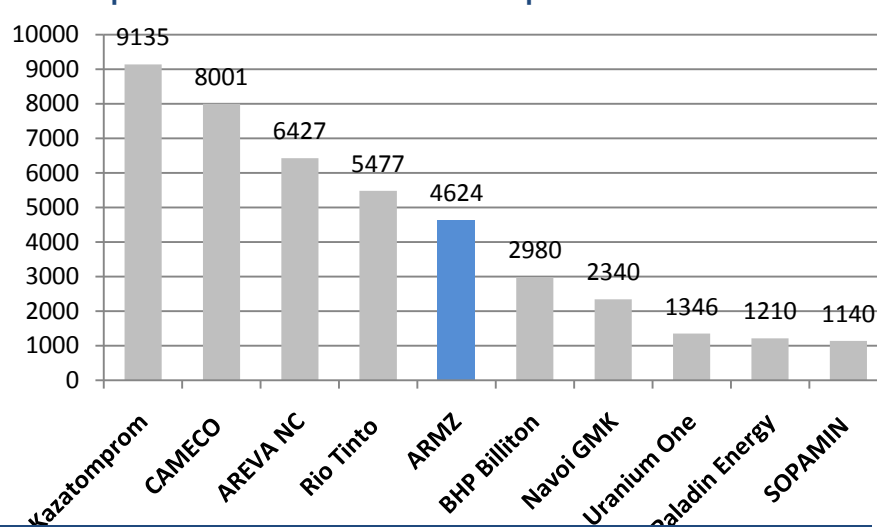
## World's largest U mines in 2009

Facility	Main owner	U production, t	% of the world total
McArthur River	Cameco	7340	15
Ranger	Rio Tinto	4423	9
Rossing	Rio Tinto	3574	7
KATCO	AREVA	3250	6
<b>Priargunsky</b>	<b>ARMZ</b>	<b>3003</b>	<b>6</b>
Olympic Dam	BHP Billiton	2981	6
Arlit	AREVA	1808	4
Rabbit-Lake	Cameco	1447	3
McClellan Lake	AREVA	1388	3
Akouta	AREVA	1435	3

## Countries – leaders of U production in 2009, tU

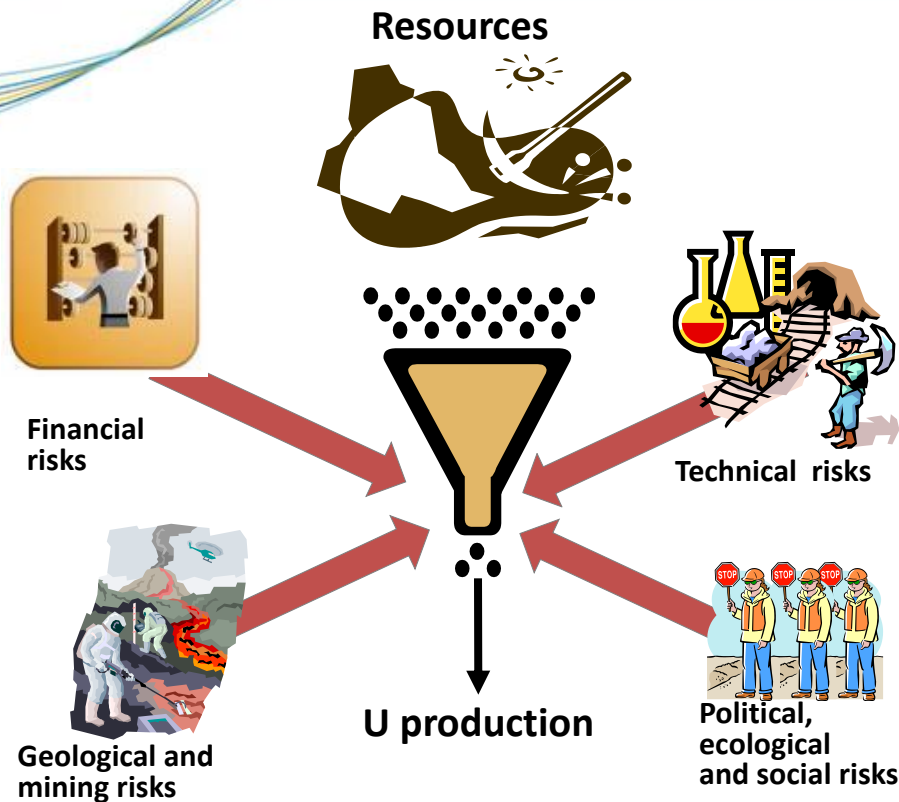


## Companies – leaders of U production in 2009, tU



Uranium prices increased in 2007 led to a growth of uranium production.  
Russia/ARMZ - world's 5<sup>th</sup> by country/company in uranium production

# Factors affected on U production plans

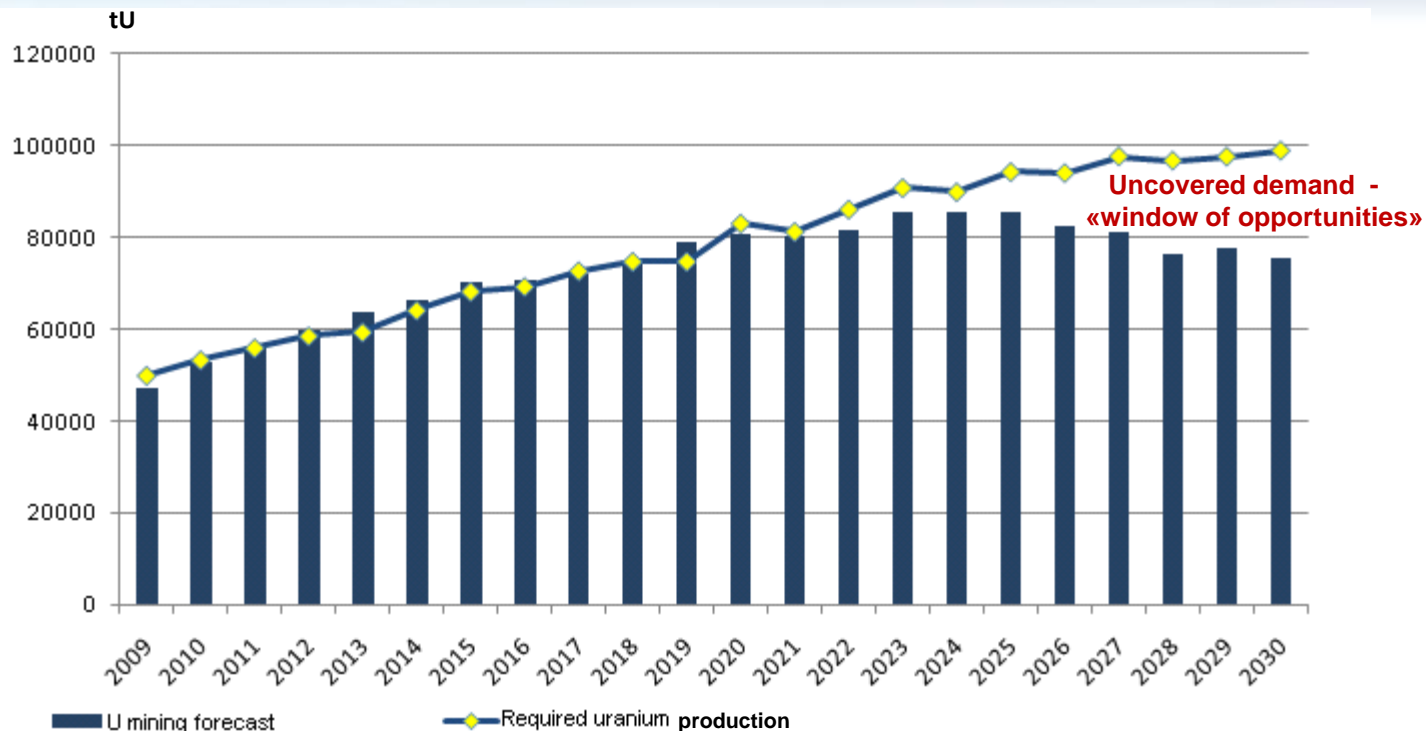


## Main risks hampered development of biggest U mining projects

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

Uranium production is behind the declared plans. Reasons:

- Speculative announcements of some companies, especially juniors
  - Financial crisis
  - Price volatility
  - Technical limitations
- Political, social and environmental factors



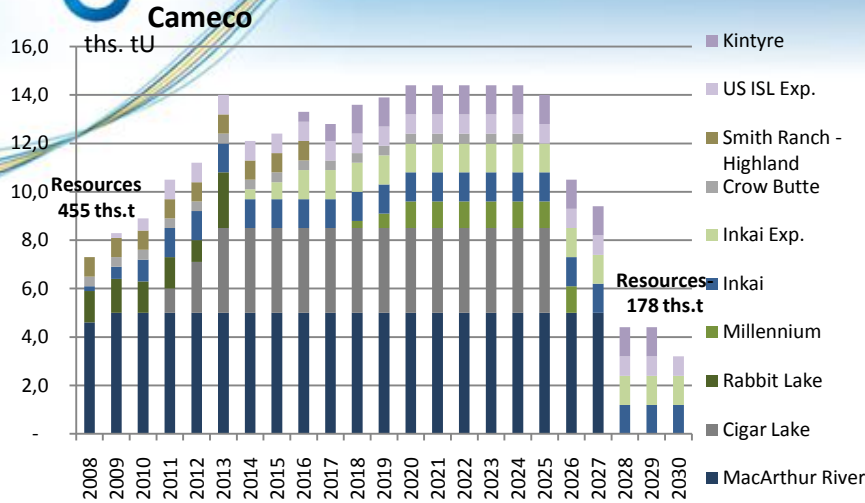
## Stages of the uranium industry development

- ❑ 2010- 2020 - reactor demand covered by uranium production
- ❑ after 2020 - uranium production shortage
- ❑ after 2025 – decrease of uranium production and production capacity shortage (decommissioning of some mines due to U resources depletion)



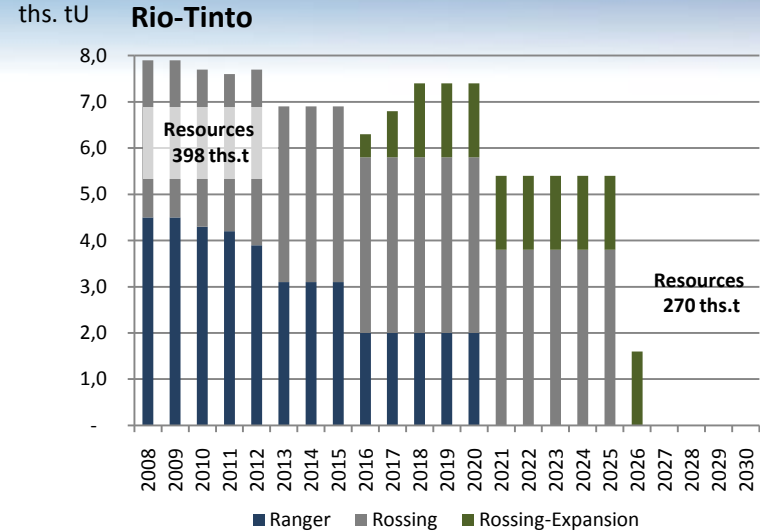


# Uranium production forecast for leading companies (ARMZ evaluation)

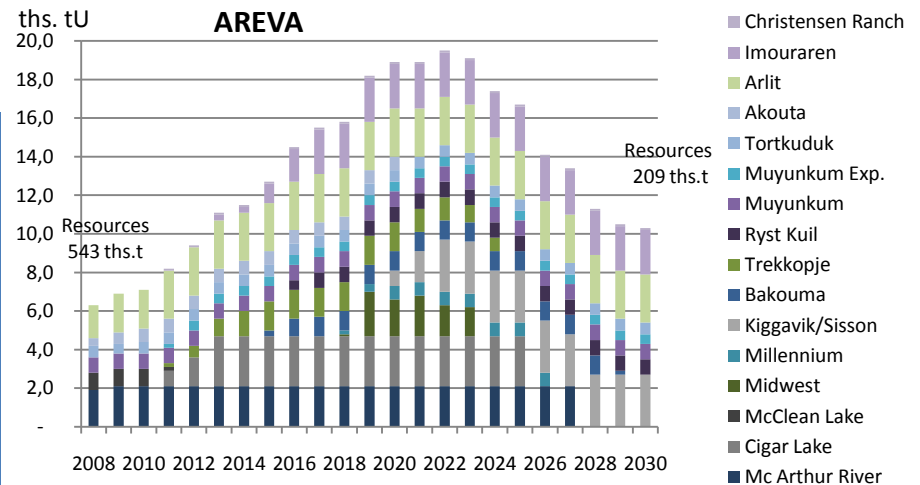


- After 2024 – sharp drop in uranium production due to the depletion of U resource base at McArthur River and Cigar Lake.
- Possible deficit of uranium resources. Residual U resources - 39% of initial.

Even subject to realization of all plans for development of new mines and expanding existing facilities, after 2025 uranium production will decrease and will cause the overall decline of uranium production.



- 2027 - production shut down, residual U resources - in Jabiluka deposit (non-developed due to social and political limitations)

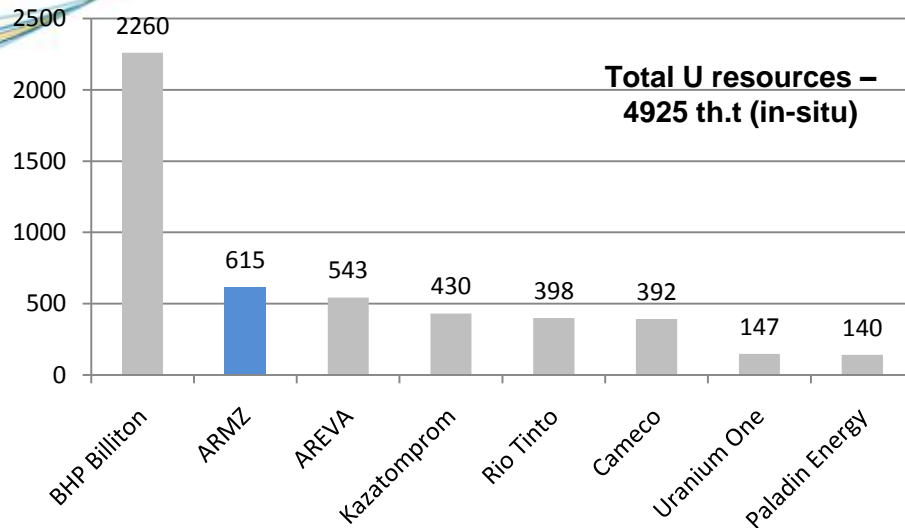


- Production decrease since 2023 (abandoned McArthur, Sigar Lake , Akouta, Trekkoppje). Residual U resources – 38% of initial.

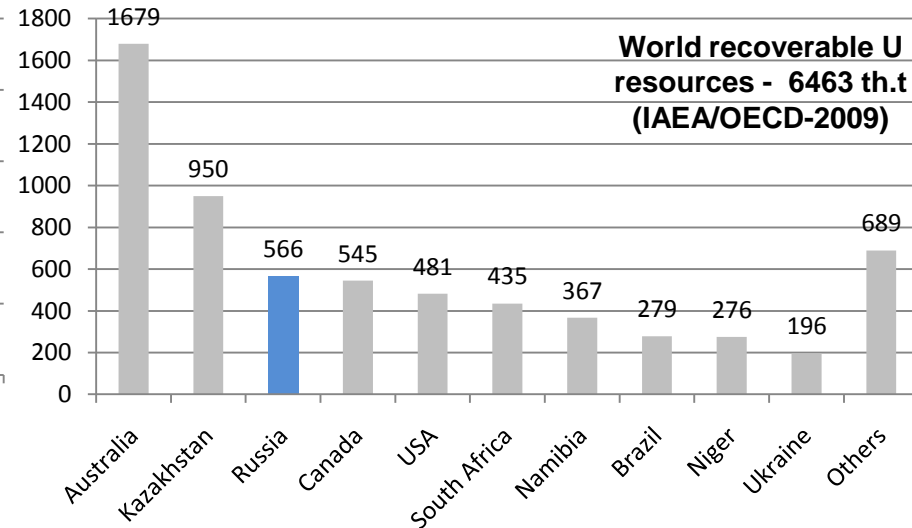


# U resources is a key factor for sustainable development of uranium production

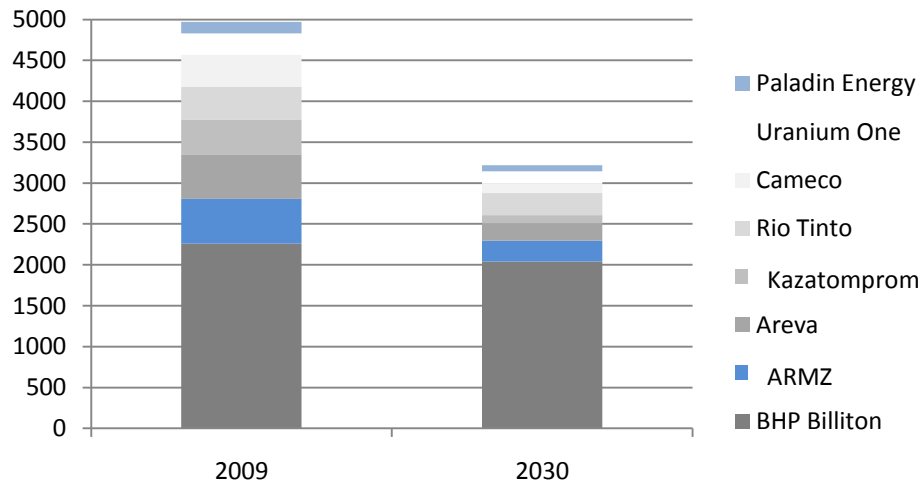
## Uranium resources by leading companies, th.tU



## Uranium resources by countries, th.tU



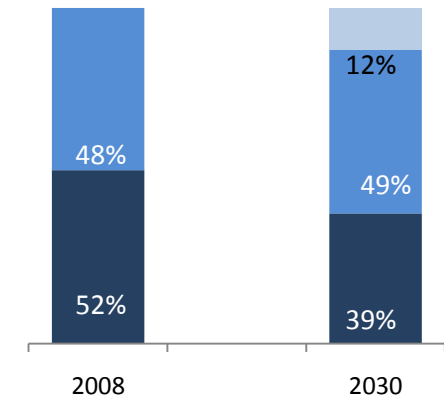
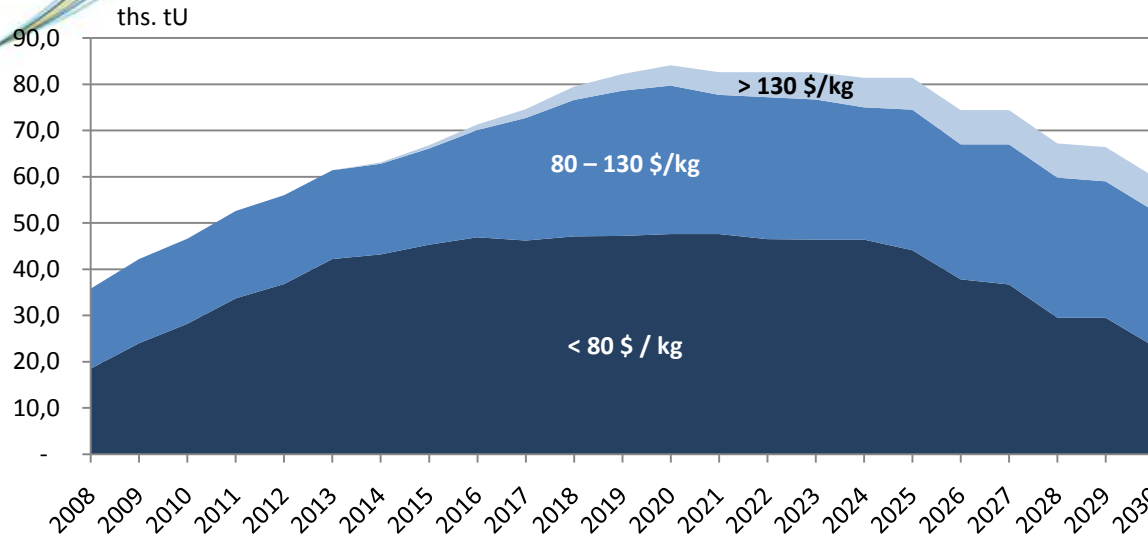
## Exhausting of U resources base by leading companies as a result of its production, th.tU



- leading companies will produce about 1.8 million tons of uranium in 2009-2030 (U resource consumption - 37%)
- 62% of the total companies' U resources will be concentrated in the Olympic Dam deposit by 2030 (copper-main commodity)
- U resources of primary uranium mines will be reduced by 2030 more than twofold

# The cost categories of U resources, involved in production

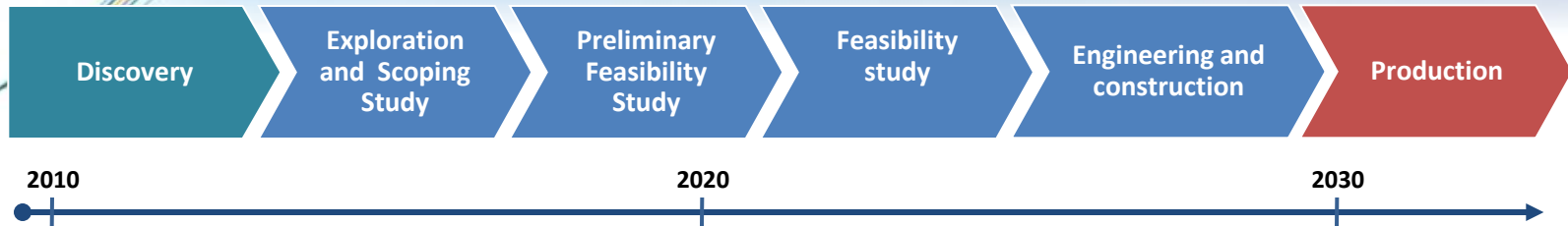
Variation of uranium resources structure on cost categories in 2008-2030



Количество месторождений/проектов стоимостной категории до 80 долл/кг:  
2009 год – 23; 2030 год – 9

- Significant reduction of large mines with the cost categories of resources <USD 80/kg U
- By 2030 large deposits (McArthur River, Cigar Lake, Rossing, Ranger, Akouta, Akdala, Inkai, Millenium, Karamurun, etc.) will be depleted
- Deposits with the resources cost >USD130\$/kg U will come into production

# Main objectives of the world uranium mining industry



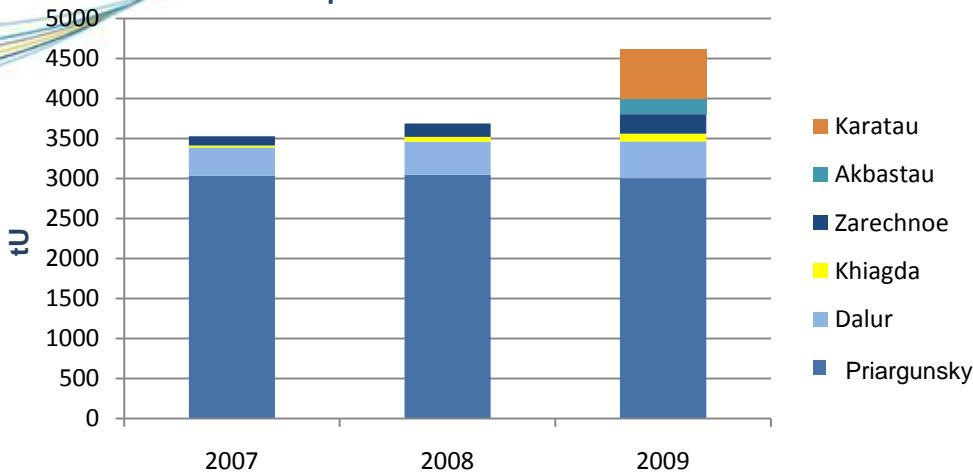
**Development of uranium project from discovery to production takes about 15-20 years**

**Main conditions for sustainable uranium mining industry development during the next 5 years:**

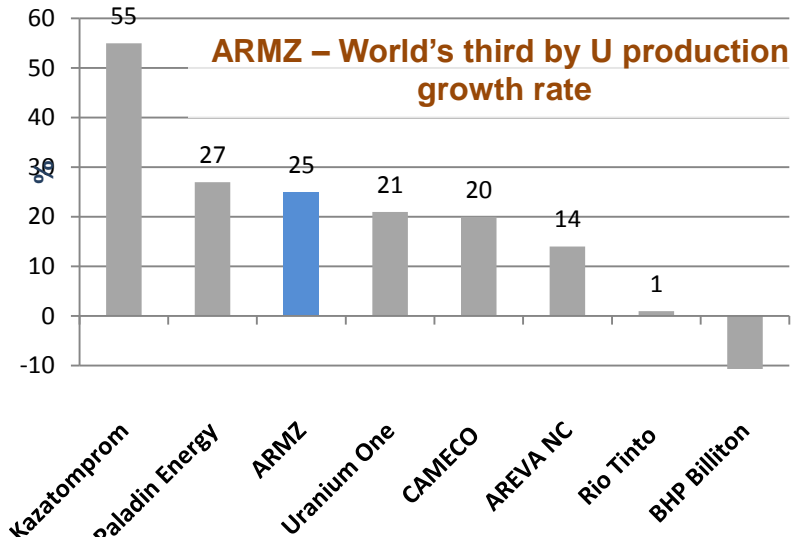
- ☐ Intensify uranium exploration aimed at discovery of new large- and medium size uranium deposits
- ☐ Reevaluate current resources and develop stand by deposits for mining
- ☐ Implement innovative environmentally harmless technologies
- ☐ Resolve staffing issues

**Realization of uranium mining plans should be associated with stable, adequate and transparent uranium market prices**

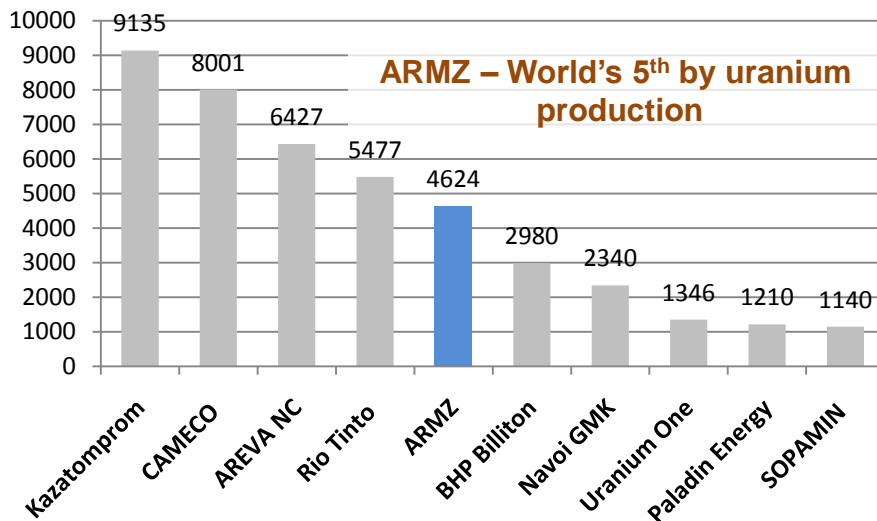
## Uranium production in 2007-2009



## Production Growth Rate In 2009



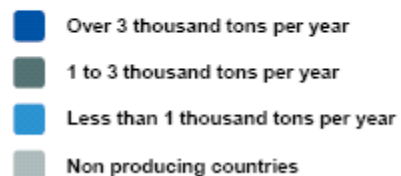
## ARMZ – one of the world leaders in U production



### 2009 :

- ✓ ARMZ produced 4624 tU - 5% more than in 2008
- ✓ Uranium production in Kazakhstan - 6,4 fold increase (from 166 tU in 2008 to 1063 tU in 2009)
- ✓ World's third by uranium production growth rate.
- ✓ World's 2nd by uranium resources (after BHP Billiton)
- ✓ U resources growth at above 100,000 tU as a result of exploration and M&A activities

## Uranium Producing Countries



### ● Operational and under construction facilities

1. Priargunsky
2. Khiagda
3. Dalur
4. Akbastau
5. Zarechnoe

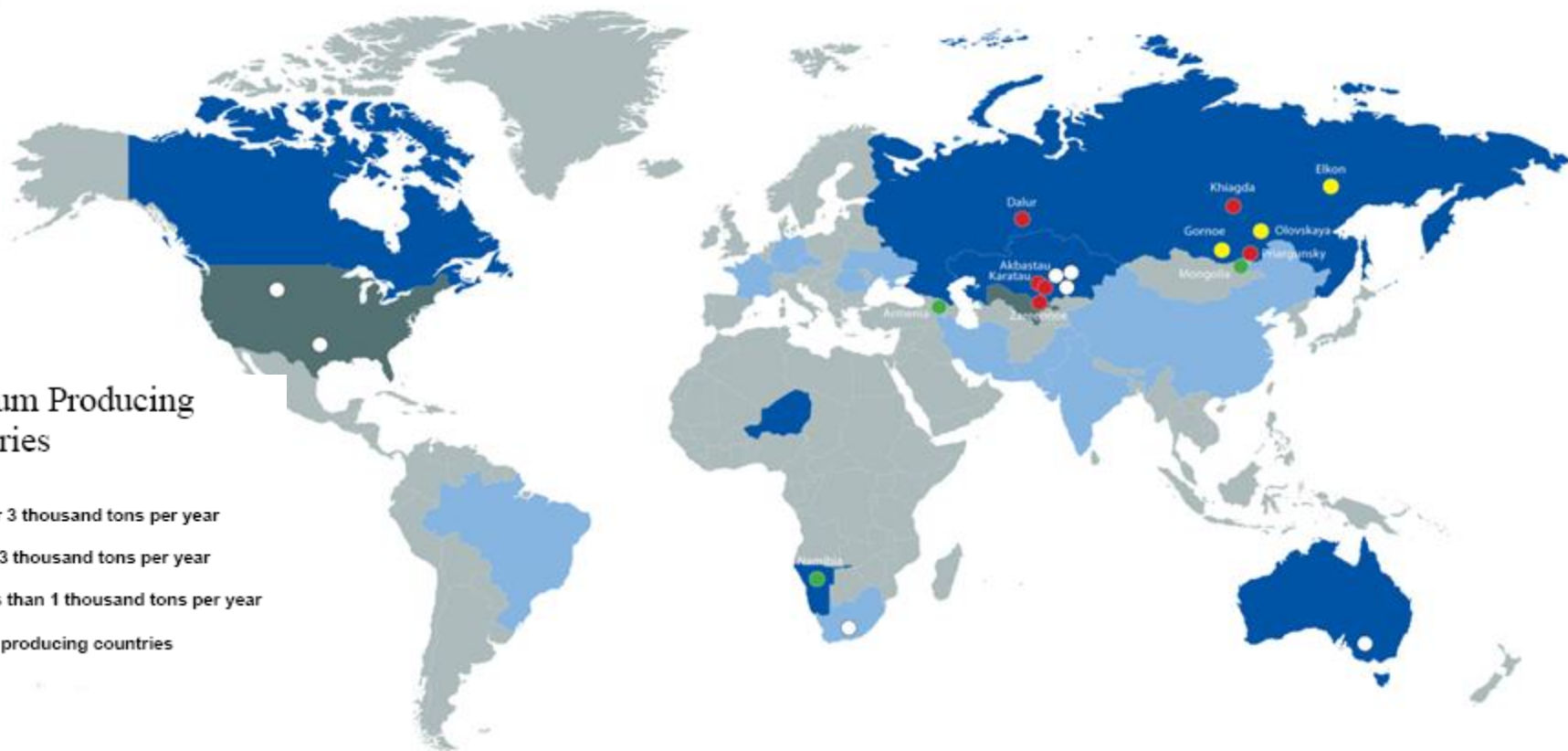
### ● Planned facilities

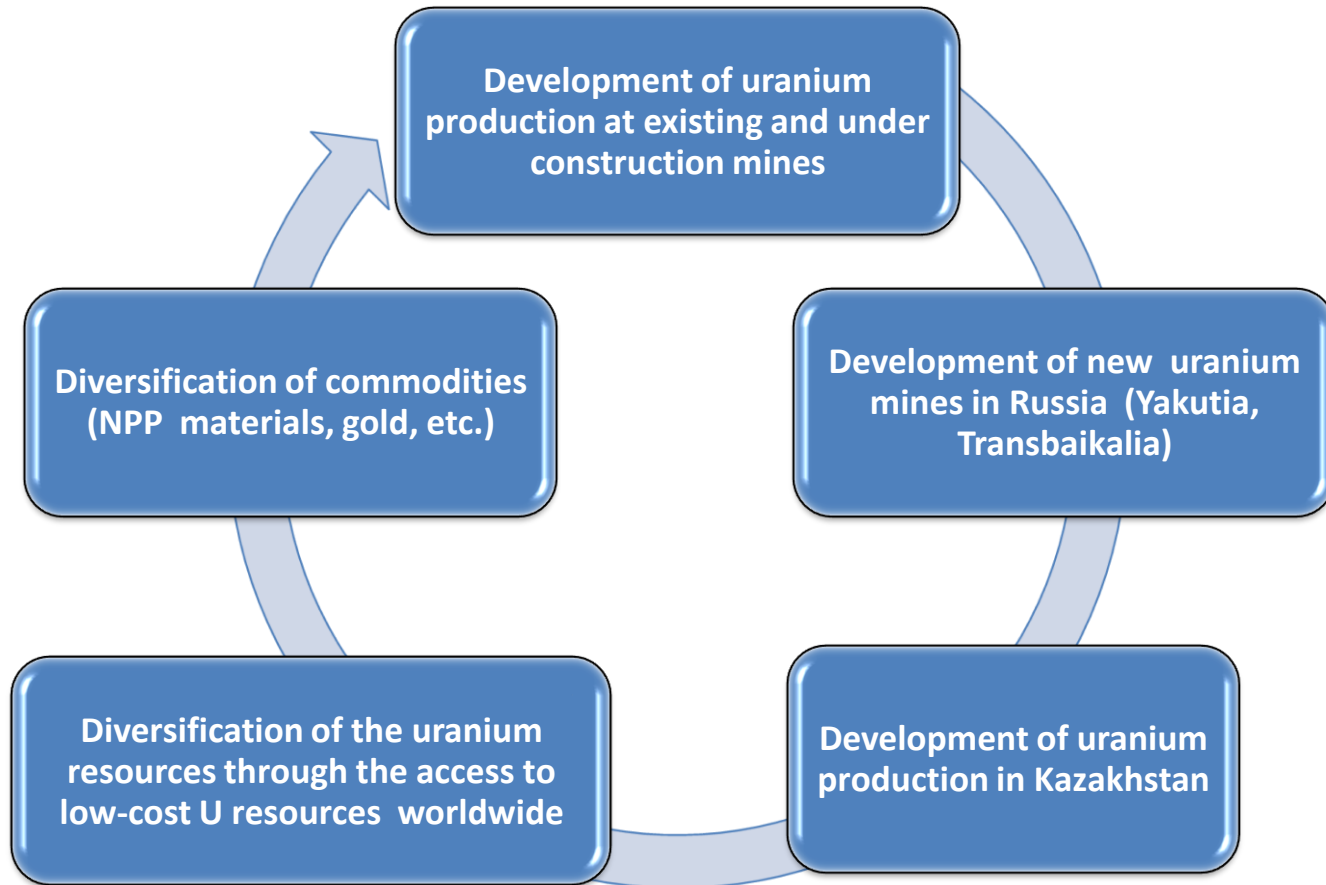
6. Elkon
7. Gornoe
8. Olovskaya

### ● Exploration ventures and Prospective projects

9. Mongolia
10. Namibia
11. Armenia

○ ARMZ- U1 alliance





**The main goal - to meet demand of Russian nuclear industry in uranium and to take a leading position on the global uranium market**





Thank you!