CURRENT AND PERSPECTIVE SITUATION REGARDING ROMANIA'S ACCESS TO NUCLEAR ENERGY RESOURCES

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1. Geological potential of the Uranium resources around the world

The evaluation of uranium resources at world level took into consideration the current international classification system and different geological resources and reserves categories definitions, presented by RED BOOK, Uranium 2011: Resources, Production and Demand, edited in 2012 by (OECD) – Nuclear Energy Agency and (IAEA) International Atomic Energy Agency.

Recuperation and costs		Identified resources		Undiscovered resources	
	< 40 $/kg U	Resources reasonably insured	Resources deduced	Resources forecasted	Speculative resources
	< 400-80 $/kg U	Resources reasonably insured	Resources deduced	Resources Forecasted	
	80 - 130 $/kg U	Resources reasonably insured	Resources deduced	Resources Forecasted	
	130 - 260 $/kg U	Resources reasonably insured	Resources deduced	Resources Forecasted	

The economic interest decreases

The estimation accuracy decreases

Figure 1 *International classification scheme (NEA/IAEA) for the uranium resources*

At the end of the year 2011, the geological potential of the identified uranium resources (the sum of reasonably insured resources and deduced resources) corroborated with the unitary production costs for a kilogram of uranium expressed as technical concentrates is synthetically presented in table no. 1.

Table 1 *The geological potential of uranium resources identified between 2009 and 2011* (1)

Resources category / Production costs level	2009 (1.000 tU)	2011 (1.000 tU)	Quantity modifications (1.000 tU)	Percentage variations (%)
Identified resources (Total)				
< 260 $/kg U	6,306.3	7,096.6	790.3	12.5
< 130 $/kg U	5,404.0	5,327.2	- 76.8	- 1.4
< 80 $/kg U	3,741.9	3,078.5	- 663.4	- 17.7
< 40 $/kg U	796.4	680.9	- 115.5	- 14.5
Reasonably insured resources				
< 260 $/kg U	4,004.5	4,378.7	374.2	9.3
< 130 $/kg U	3,524.9	3,455.5	- 69.4	- 2.0
< 80 $/kg U	2,516.1	2,014.8	- 501.3	- 19.9
< 40 $/kg U	569.9	493.9	- 76.0	- 13.3
Deduced resources				
< 260 $/kg U	2,301.8	2,717.9	416.1	18.1
< 130 $/kg U	1,879.1	1,871.7	- 7.4	- 0.4
< 80 $/kg U	1,225.8	1,063.7	- 162.1	- 13.2
< 40 $/kg U	226.6	187.0	- 39.6	- 17.5

The data presented show that overall, the identified uranium resources diminished significantly for those groups of uranium resources that can be achieved with low production costs, i.e.: (- 17.7%) for the group (< 80 $/kg U) and (- 14.5%) for the group (< 40 $/kg U). The decrease of reasonably insured resources and of resources deduced from the low production costs uranium resources groups (< 40 $/kg U and < 80 $/kg U) was determined by the preferential exploitation made by the companies which produce them. The contribution of new geological resources from the detailed geological exploration works does not cover the consumption. In these circumstances, geological and mining operators focused their attention towards the group of identified uranium resources with high production costs (< 260 $/kg U), which had a positive trend of + 12.5%.

Regarding the potential of identified uranium resources from the medium production costs group (< 130$/kg U), the trend was balanced, with a small percentage drop of -1.4 %.

Table 2 *Identified resources world geological potential (tU) - 01.01. 2011* (1)

Country	Production costs categories			
	< 40 USD/kg U	**< 80 USD/kg U**	**< 130 USD/kg U**	**< 260 USD/kg U**
Algeria	0	0	0	19,500
Argentina	2,400	9,000	18,500	19,600
Australia	0	1,349,400	1,661,600	1738,800
Botswana	0	0	0	82,200
Brazil	137,900	229,300	276,700	276,700
Canada	350,800	416,800	468,700	614,400
Central African Republic	0	0	12,000	12,000
Chile	0	0	0	1,900
China	59,200	135,000	166,100	166,100
D,R of Congo	0	0	0	2,700
Czech Republic	0	0	400	400
Egypt	0	0	0	1,900
Finland	0	0	1,100	1,100
France	0	0	0	11,600
Gabon	0	0	4,800	5,800
Germany	0	0	0	7,000
Greece	0	0	0	7,000
Greenland	0	0	0	134,700
Hungary	0	0	0	8,600
India	0	0	0	104,900
Indonesia	0	2,000	8,400	10,600
Iran	0	0	2,500	2,500
Italy	0	0	6,100	6,100
Japan	0	0	6,600	6,600
Jordan	0	0	33,800	33,800
Kazakhstan	47,400	485,800	629,100	819,700
Malawi	0	0	12,300	17,000
Mexico	0	0	2,800	2,800
Mongolia	0	0	55,700	55,700
Namibia	0	6,600	261,000	518,100
Nigeria	5,500	5,500	421,000	445,500
Peru	0	2,600	2,600	2,600
Portugal	0	4,500	7,000	7,000
Romania	**0**	**0**	**6,700**	**6,700**
Russian Federation	0	55,400	487,200	650,300
Slovakia	0	5,900	9,000	9,000
Slovenia	0	5,500	9,200	9,200
Somalia	0	0	0	7,600
South Africa	0	186,000	279,100	372,100
Spain	0	0	0	14,000
Sweden	0	0	10,000	13,500
Tanzania	0	0	36,700	45,700
Turkey	0	7,300	7,300	7,300
„„	6,400	61,500	119,600	224,600
USA	0	39,100	207,400	472,100
Uzbekistan	71,300	71,300	96,200	96,200
Vietnam	0	0	0	6,400
Zambia	0	0	0	15,600
Zimbabwe	0	0	0	1,400
TOTAL	**680,900**	**3,078,500**	**5,327,200**	**7,096,600**

The data presented synthetically in table no. 2 leads us to the following relevant elements:

i. In the cost production category (< 40 $/kg U), identified uranium resources on the world map are located on the territories of just 8 states; these are concentrated in a percentage of 82.24% in three countries: Canada – 51.52%, Brazil – 20.25% and Uzbekistan – 10.47%.

ii. In the cost production category (< 80 $/kg U), identified uranium resources on the world map are located in just 19 states; These are concentrated in a percentage of 91.03% in six countries: Australia – 43.83%, Kazakhstan – 15.78%, Canada – 13.54%, Brazil – 7.45%, South Africa – 6.04% and China – 4.39%.

iii. In the (< 130 $/kg U) cost production category, identified uranium resources are concentrated in a percentage of 88.45% in nine states: Australia – 31.19%, Kazakhstan – 11.81%, Russia – 9.15%, Canada – 8.80%, Niger – 7.90%, Namibia – 5.28%, South Africa – 5.24%, Brazil – 5.19% and USA – 3.89%.

iv. From the identified uranium resources point of view, Romania is among the leading members of the EU:

- in the (< 130 $/kg U) production costs category, it occupies fourth place (being preceded in order by: Slovakia and Portugal);
- in the (< 260 $ / kg U) production costs category, it occupies seventh place (being preceded in order by: France, Slovakia, Hungary, Greece and Germany).

If we were to take into our comparative analysis regarding identified resources of uranium the ones with the highest level of discovery and confirmation (reasonably insured resources), Romania would be on the third position among EU members, being preceded only by Portugal and Italy.

v. Reasonably insured uranium resources and deduced uranium resources have a similar configuration with regard to distribution at a global level – also, this is shown by the data presented below in table no. 3 and respectively no. 4.

Table 3 *World geological potential (tU) of reasonably insured resources - 01.01. 2011* (1)

Country	Production costs categories			
	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Algeria	0	0	0	19,500
Argentina	0	5,000	8,600	8,600
Australia	0	961,500	1,158,000	1,180,100
Botswana	0	0	0	23,100
Brazil	137,900	155,700	155,700	155,700
Canada	237,900	292,500	319,700	421,900
Central African Republic	0	0	12,000	12,000
Chile	0	0	0	700
China	45,800	88,500	109,500	109,500
D.R of Congo	0	0	0	1,400
Finland	0	0	1,100	1,100
France	0	0	0	11,500
Gabon	0	0	4,800	4,800
Germany	0	0	0	3,000
Greece	0	0	0	1,000
India	0	0	0	77,000
Indonesia	0	2,000	8,400	8,400
Iran	0	0	700	700
Italy	0	0	4,800	4,800
Japan	0	0	6,600	6,600
Kazakhstan	17,400	244,900	319,900	402,400
Malawi	0	0	10,000	11,300
Mexico	0	0	2,800	2,800
Mongolia	0	0	30,600	30,600
Namibia	0	5,900	234,900	362,600
Nigeria	5,500	5,500	339,000	340,600
Peru	0	1,300	1,300	1,300
Portugal	0	4,500	6,000	6,000
Romania	0	0	3,100	3,100
Russian Federation	0	11,800	172,900	218,300
Slovenia	0	1,700	1,700	1,700
Somalia	0	0	0	5,000
South Africa	0	96,400	144,600	192,900
Spain	0	0	0	14,000
Sweden	0	0	4,000	5,000
Tanzania	0	0	28,700	30,100
Turkey	0	7,300	7,300	7,300
Ukraine	2,800	44,600	86,800	143,300
USA	0	39,100	207,400	472,100
Uzbekistan	46,600	46,600	64,300	64,300
Vietnam	0	0	0	1,000
Zambia	0	0	0	9,900
Zimbabwe	0	0	0	1,400
TOTAL	**493,900**	**2,014,800**	**3,455,500**	**4,3787,000**

Table 4 *World geological potential (tU) of deduced resources - 01.01. 2011* [1]

Country	Production costs categories			
	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Argentina	2,400	4,000	9,900	11,000
Australia	0	387,900	503,600	558,700
Botswana	0	0	0	59,100
Brazil	0	73,600	121,000	121,000
Canada	112,900	124,300	149,000	192,500
Chile	0	0	0	1,200
China	13,400	468,500	56,600	56,600
D.R of Congo	0	0	0	1,300
Czech Republic	0	0	100	100
Egypt	0	0	0	1,900
France	0	0	0	100
Gabon	0	0	0	1,000
Germany	0	0	0	4,000
Greece	0	0	0	6,000
Greenland	0	0	0	134,700
Hungary	0	0	0	8,600
India	0	0	0	27,900
Indonesia	0	0	0	2,200
Iran	0	0	1,800	1,800
Italy	0	0	1,300	13,800
Jordan	0	0	33,800	33,800
Kazakhstan	30,000	240,900	309,200	417,300
Malawi	0	0	2,300	5,700
Mongolia	0	0	25,100	25,100
Namibia	0	7,900	26,100	155,500
Nigeria	0	0	82,000	104,900
Peru	0	0	1,000	1,000
Portugal	0	4,500	6,000	6,000
Romania	0	0	3,600	3,600
Russian Federation	0	43,600	314,300	432,000
Slovakia	0	5,900	9,000	9,000
Slovenia	0	3,800	7,500	7,500
Somalia	0	0	0	2,600
South Africa	0	89,600	134,400	179,200
Sweden	0	0	6,000	8,500
Tanzania	0	0	8,000	15,600
Ukraine	3,600	16,900	32,900	81,300
Uzbekistan	24,700	24,700	31,900	31,900
Vietnam	0	0	0	5,400
Zambia	0	0	0	5,700
TOTAL	**187,000**	**1,063,700**	**1,871,700**	**2,717,900**

vi. Reasonably insured uranium resources and deduced uranium resources are drawn into the economical industrial scale exploitation circuit by different methods of underground exploitation, current exploitation methods (quarry), acid or alkaline lixiviation on site (in the reservoir) and by processing secondary uranium products.

By analyzing the centralized situation of reasonably insured resources (RIR) – recoverable uranium geological resources, presented in table no. 5, it is clear that underground mining exploitations gather the most important RIRs in the reduced production costs category, (< 40 $/kg U): 63.54%.

For other production costs categories (< 80 $/kg U, < 130 $/kg U and < 260 $/kg U) a significant weight is attributed to reasonably insured resources which derive from processing secondary uranium products, with percentages of: 54.71%, 33.30% and 27.38%.

For deduced uranium resources - please see table no. 6, in the reduced production costs category (< 40 $/kg U) the majority goes to current mining exploitations (quarries), with a percentage of 64.47%.

Table 5 *Reasonably insured resources (tU) based on the exploitation method – 01.01. 2011* [(1)]

Production method	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Current mining exploitations – quarries	28,600	99,600	868,700	1,286,000
Underground mining exploitations	313,800	428,900	875,800	1,272,000
Acid lixiviation - on site	80,400	347,400	438,700	426,700
Alkaline lixiviation - on site	0	36,600	88,500	111,000
By-product (secondary product)	71,100	1,102,300	1,150,700	1,198,900
Unspecified	0	0	33,100	84,100
TOTAL	**493,900**	**2,014,800**	**3,455,500**	**4,378,700**

Table 6 *Deduced resources (tU) based on the exploitation method – 01.01. 2011* [(1)]

Production method	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Current mining exploitations – quarries	120,500	180,800	606,400	873,700
Underground mining exploitations	13,300	24,600	194,900	496,900
Acid lixiviation - on site	53,100	314,900	388,000	395,000
Alkaline lixiviation - on site	0	0	0	0
By-product (secondary product)	0	503,500	596,700	648,000
Unspecified	0	40,000	86,700	304,300
TOTAL	**186,900**	**1,063,800**	**1,871,700**	**2,717,900**

vii. Looking from the perspective of the methods/processing technologies – tables no. 7 and 8, reasonably insured uranium resources and deduced uranium resources have a majority weight – regardless of the cost production category, through the conventional processing method (composed of mineralogical operations for grain size preparation, followed by hydrometallurgical concentration).

Table 7 *Reasonably insured resources (tU) based on the processing method – 01.01. 2011* [(1)]

Production method	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Conventional in quarries	6,800	59,500	798,300	1,186,500
Conventional in the underground	313,800	1,446,900	1,920,500	2,377,400
Acid lixiviation on site	80,400	347,400	438,700	426,700
Alkaline lixiviation - on site	0	36,600	88,500	111,000
Local lixiviation	0	0	500	500
Group lixiviation in quarries	21,800	35,500	72,700	100,400
Underground group lixiviation	0	0	13,100	13,100
Unspecified	71,100	88,900	123,200	163,100
TOTAL	**493,900**	**2,014,800**	**3,455,500**	**4,378,700**

Table 8 *Deduced resources (tU) based on the processing method – 01.01. 2011* [(1)]

Production method	< 40 USD/kg U	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U
Conventional in quarries	2,500	12,300	143,300	349,600
Conventional in the underground	120,400	653,200	1,122,900	1,450,400
Acid lixiviation on site	53,100	314,900	388,000	395,000
Alkaline lixiviation - on site	0	0	0	0
Local lixiviation	0	0	2,100	2,100
Group lixiviation in quarries	10,900	12,200	12,500	105,400
Underground group lixiviation	0	0	3,800	7,500
Unspecified	0	71,200	199,100	407,900
TOTAL	**186,900**	**1,063,800**	**1,871,700**	**2,717,900**

viii. The summarized situation of the undiscovered uranium resources (prognosticated resources and speculative resources) is presented in table no. 9. The data included in this table (actually, the data missing from this one – NA – unavailable data) show the high level of confidentiality granted to quantitative and qualitative attributes characterizing uranium build-ups which are not properly exploited at an industrial scale (in the design, construction or operational phase).

Table 9 *Undiscovered resources (1.000 tU) - 01.01. 2011* [(1)]

Country	Prognosticated resources			Speculative resources			TOTAL
	Production costs category			Production costs category			
	< 80 USD/kg U	< 130 USD/kg U	< 260 USD/kg U	< 130 USD/kg U	< 260 USD/kg U	Unspecified costs	
Argentina	NA	1.4	1.4	NA	NA	NA	NA
Brazil	300.0	300.0	300.0	NA	NA	500.0	500.0
Bulgaria	NA	NA	25.0	NA	NA	NA	NA
Canada	50.0	150.0	150.0	700.0	700.0	NA	700.0
Chile	NA	NA	2.3	NA	NA	2.3	2.3
China	3.6	3.6	3.6	4.1	4.1	NA	4.1
Columbia	NA	11.0	11.0	217.0	217.0	NA	217.0
Czech Republic	NA	0.2	0.2	NA	NA	179.0	179.0
Germany	NA	NA	NA	NA	NA	74.0	74.0
Greece	6.0	6.0	6.0	NA	NA	NA	NA
Hungary	NA	NA	12.8	NA	NA	NA	NA
India	NA	NA	63.6	NA	NA	17.0	17.0
Indonesia	NA	NA	23.5	NA	NA	22.0	22.0
Iran	0.0	15.0	15.0	0.0	50.0	NA	50.0
Italy	NA	NA	NA	NA	10.0	NA	10.0
Jordan	0.0	15.0	15.0	0.0	50.0	NA	50.0
Kazakhstan	335.0	498.0	500.0	227.0	300.0	NA	300.0
Mexico	NA	3.0	3.0	NA	NA	10.0	10.0
Mongolia	21.0	21.0	21.0	1,390.0	391.0	NA	1,390.0
Nigeria	0.0	13.6	13.6	0.0	51.3	NA	51.3
Peru	6.0	20.0	20.0	19.7	19.7	NA	19.7
Portugal	1.0	1.5	1.5	NA	NA	NA	NA
Romania	NA	3.0	3.0	3.0	3.0	NA	3.0
Russian Federation	0.0	191.8	191.0	NA	NA	772.0	772.0
Slovakia	2.2	7.2	7.2	NA	NA	NA	NA
Slovenia	0.0	1.1	1.1	NA	NA	NA	NA
South Africa	34.9	110.3	110.3	NA	NA	1,112.9	1,112.9
Ukraine	0.0	8.4	22.5	0.0	120.0	255.0	375.0
Uzbekistan	24.8	24.8	24.8	0.0	0.0	0.0	0.0
Venezuela	NA	NA	NA	0.0	0.0	163.0	163.0
Vietnam	0.0	7.9	7.9	100.0	100.0	130.0	230.0
Zambia	0.0	22.0	22.0	NA	NA	NA	NA
Zimbabwe	0.0	0.0	0.0	25.0	25.0	NA	25.0
TOTAL	**1,624.1**	**2,698.0**	**2,841.3**	**3,543.8**	**3,862.1**	**3,733.2**	**7,595.3**

It can seem interesting for an untrained person, that these undiscovered resources, although having a low degree of certainty (confirmation) from a geological, mining and mineralogical point of view, they are kept as strict secret information if we compare them to identified resources.

In the case of identified uranium resources, the exploitation is often conditioned by a financing from drawn sources (capital market or bank market) which means that the financers know what they spend their money on and in what period of time that money will be recovered.

This is not possible without a quantitative and qualitative production grading, which can be achieved in the life span of the extracting industrial entity. This implies the presentation of complete information and data which characterize the reservoir drawn in the economical circuit of industrial development.

For undiscovered resources, their owners keep the confidentiality of information at high levels because this allows them to apply active market strategies, to become competitive players, which means they can buy when the prices are low and sell when the price of uranium technical concentrates is high.

At least for those reasons, Romania must continue its exploitation and processing activities for internal uranium reservoirs, keeping geological, mining and mineralogical information a state secret and, as the case may be, at other secret levels (S – secret, SS – strictly secret, SSHI – strictly secret of high importance).

ix. To achieve a quantity balance – based on time, between the demanded quantity of uranium fuel in the nuclear-energetic facilities and the supply potential (covering the consumption) of the geological uranium resources, we must look at the current status of government and commercial stocks of uranium technical concentrates.

This information is considered to be strategically important and, as such, it is kept as strictly secret data – table no. 10.

Table 10 *Uranium stocks (tU) at world level – 01-01. 2011* [(1)]

Country	Natural uranium	Enriched uranium
Argentina	52	0
Bulgaria	0	81
Hungary	5	0
P.R. of Korea	2,000	6,000
Portugal	168	0
Spain	NA	**> 611**
Switzerland	1,674	997
Turkey	2	0
USA	36,381	26,982
TOTAL	**40,482**	**> 34,671**

x. Regarding the variations of identified uranium resources between the years 2009 and 2011 (determined on one side by the rise generated by geological exploitation works and on the other side by the drop caused by the exploitation-processing works) for the main global operators; these are shown in table no. 11.

Significant increases were registered by the African states: Botswana, Malawi, Namibia and Nigeria.

Table 11 – *Major modifications of the identified uranium resources (1.000 tU)*[(1)]

Country	Resources category /	2009	2011	Modifications	Reasons for the modifications
Australia	**RIR**				The resources migrated towards categories with superior production costs because of the increase in mining exploitations costs
	< 80 USD/kg U	1,163	961	-202	
	< 130 USD/kg U	1,176	1,158	-18	
	< 260 USD/kg U	1,179	1,180	+1	
	DR				
	< 80 USD/kg U	449	388	-61	
	< 130 USD/kg U	497	504	+7	
	< 260 USD/kg U	500	559	+59	
Botswana	**RIR**				Recent geological exploitations activities have identified reservoirs with significantly reduced costs
	< 260 USD/kg U	0	23	+23	
	DR				
	< 260 USD/kg U	0	59	+59	
Canada	**RIR**				RIRs have migrated to superior production costs due to the increase in mining costs; the increase in deduced resources (RD) is caused by the discovery of new reservoirs in the Athabasca area
	< 40 USD/kg U	267	238	-29	
	< 80 USD/kg U	337	293	-44	
	< 130 USD/kg U	361	320	-41	
	< 260 USD/kg U	387	422	+35	
	DR				
	< 40 USD/kg U	100	113	+13	
	< 80 USD/kg U	111	124	+13	
	< 130 USD/kg U	124	149	+25	
	< 260 USD/kg U	157	193	+36	
Greenland	**DR**				Previous data was reported by Denmark
	< 260 USD/kg U	86	135	+49	
India	**RIR**				The broadening of the knowledge towards the mineral uranium reservoirs in the Cuddapah deposit.
	< 260 USD/kg U	55	77	+22	
	DR				
	< < 260 USD/kg U	25	28	+3	
Jordan	**RIR**				Conservative revaluation of estimated old uranium resources
	< 130 USD/kg U	44	0	-44	
	< 260 USD/kg U	44	0	-44	
	DR				
	< 130 USD/kg U	68	34	-34	
	< 260 USD/kg U	68	34	-34	
Kazakhstan	**RIR**				Revaluation of resources in the reduced costs category and exploitation has reduced the total volume of resources. The decrease in the production costs for resources from sandstone deposits and the upgrade of
	< 40 USD/kg U	15	17	+2	
	< 80 USD/kg U	234	245	+11	
	< 130 USD/kg U	336	320	-16	
	< 260 USD/kg U	414	402	-12	
	DR				
	< 40 USD/kg U	30	30	0	

	< 80 USD/kg U	242	241	-1	resources from prognosticated to RIR has led to the increase of reduced cost RIRs
	< 130 USD/kg U	316	309	-7	
	< 260 USD/kg U	418	417	-1	
Malawi	**RIR**				Mining activities have reduced RIR, but exploration has led to an increase in deduced resources
	< 130 USD/kg U	14	10	-4	
	< 260 USD/kg U	14	11	-3	
	DR				
	< 130 USD/kg U	1	2	+1	
	< 260 USD/kg U	1	6	+5	
Mongolia	**RIR**				New deposits found by exploration and the revaluation of existing deposits have led to an increase in resources and the migration towards higher costs categories
	< 80 USD/kg U	38	0	-38	
	< 130 USD/kg U	38	31	-7	
	< 260 USD/kg U	38	31	-7	
	DR				
	< 80 USD/kg U	4	0	-4	
	< 130 USD/kg U	12	25	+13	
	< 260 USD/kg U	12	25	+13	
Namibia	**RIR**				Extensive exploration has led to the discovery of important uranium resources with reduced costs
	< 80 USD/kg U	2	6	+4	
	< 130 USD/kg U	157	235	+78	
	< 260 USD/kg U	157	363	+206	
	DR				
	< 80 USD/kg U	0	1	+1	
	< 130 USD/kg U	127	26	-101	
	< 260 USD/kg U	127	156	+29	
Nigeria	**RIR**				The revitalization of mining activities has led to the discovery of new uranium resources, mainly in the Imouraren deposit
	< 40 USD/kg U	17	6	-11	
	< 80 USD/kg U	43	6	-37	
	< 130 USD/kg U	242	339	+97	
	< 260 USD/kg U	245	341	+96	
	DR				
	< 40 USD/kg U	0	0	0	
	< 80 USD/kg U	31	0	-31	
	< 130 USD/kg U	31	82	+51	
	< 260 USD/kg U	31	105	+74	
Russia	**RIR**				New deposits identified by exploration and the revaluation of exiting deposits have substantially increased resources and have moved them in higher costs categories
	< 80 USD/kg U	100	12	-88	
	< 130 USD/kg U	181	173	-8	
	< 260 USD/kg U	181	218	+37	
	DR				
	< 80 USD/kg U	58	44	-14	
	< 130 USD/kg U	299	314	+15	
	< 260 USD/kg U	385	432	+47	
South Africa	**RIR**				The increase of resources through uranium ponds evaluation and limited exploration, but also the increase of exploration costs have moved resources in higher costs categories
	< 80 USD/kg U	142	96	-46	
	< 130 USD/kg U	195	145	-50	
	< 260 USD/kg U	195	193	-2	
	DR				
	< 80 USD/kg U	91	90	-1	
	< 130 USD/kg U	100	134	+34	
	< 260 USD/kg U	100	179	+79	
Uzbekistan	**RIR**				Resources presented in the previous edition were estimated by the Secretariat. Current uranium resources have been declared by the country
	< 40 USD/kg U	0	47	+47	
	< 80 USD/kg U	55	47	-8	
	< 130 USD/kg U	76	64	-12	
	< 260 USD/kg U	76	64	-12	
	DR				
	< 40 USD/kg U	0	25	+25	
	< 80 USD/kg U	31	25	-6	
	< 130 USD/kg U	39	32	-7	
	< 260 USD/kg U	39	32	-7	

These variations recorded for identified uranium resources throughout the period 2009-2011 are complemented by a series of geological, mining and mineralogical data and information resulted from wildcat drillings, researched until 2011.

Synthesized, the most important uranium prospects perimeters evaluated at world scale – with final research phase in the year 2011 (EU members are missing completely) are presented in table 12.

Table 12 *New mining prospects (estimated annual production capacity tU)*[1]

Country	Production centre
Australia	Yeelirrie
	Four Mile
Canada	Midwest (2,300 U tons/year)
	Millenium (2,750 U tons/year)
	Kiggavik (3,000 U tons/year)
Mongolia	Gurvansaikhan (Hairhan deposit)
	Coge – Gobi
	Emeelt (Gurvanbulang deposit)
Namibia	Rossing (planned expansion)
South Africa	Dominios Reefs (will be reopened)
USA	Fost Kreek (769 U tons/year)
	Nichols Ranch
	Goliad Uranium (385 U tons/year)
	Jab and Antelope (769 U tons/year)
	Moore Ranch (192 U tons/year)
	Pinon Ridge Mill (385 U tons/year)
Zambia	Mutanga

xi. On a global scale, new mining exploitations, planned or already in different construction phases for the 2011 – 2020 time horizon, are presented in table no. 13.

Table 13 *New mining exploitations planned or under construction (tU/year)*

Country	Production centre	2012	2013	2014	2015	2016	2017	2018	2019	2020
Argentina	Cerro Solo					100				
Australia	Kintyre				2,650					
	Wiluna		850							
Brazil	Lagoa Real				330					
	Santa Qiteria				970					
Canada	Cigar Lake		5,000							
Finland	Talvivaara	350								
India	Mohuldih									
	Tummalapalle	220								
	Gogi			130						
	Lampubar P.					130				
	K.P.N.						340			
Iran	Ardakan	50								
Jordan	JFUMC									2.000
Kazakhstan	Semzzbaz I.	500								
	Kharasan-1				500					
	Kharasan-2	1,500								
	Inkai 1,2,3				500					
	Zhalpak		500			250				
	Moinkum 3	250						250		
Malawi	Kazelekera	190								
Namibia	Langer H.				1,820					
	Trekkopje	2,000								
	Valencia				1,350					
	Rossing South			5,800	2,650					
Nigeria	Imouraren		5,000							
Russia	Khiagda			1,600				1,800		
	Elkon								5,000	
	Gornoe		300							
	Olovskaya				600					
Tanzania	Mkuju River			2,000						
Ukraine	Hydromet. 2			1,200						
TOTAL		5,060	11,650	10,730	11,370	480	340	2,050	5,000	2,000

Previously presented data underline the fact that the only EU member that is part of this summary situation is Finland; this proves that primary uranium energy resources are extremely scarce and cannot cover the necessity of the common European market from internal geological resources for the entire period analyzed.

The largest production capacities will be commissioned in African countries, such as: Namibia, Tanzania, Malawi and Nigeria, respectively 20,810 tU/year, which represents 42.75% of the world estimated total.

The exploitation and processing of these resources from the African continent will be based on joint-venture partnerships between the respective states and major multinational companies which operate in this field (AREVA, Cameco, Rio Tinto, BHP Billiton, etc.).

A series of other capacities will be exploited in states which will direct newly obtained productions towards their own nuclear energy units and will not sell them on the international market, more exactly:

- Russia: facilities in development or under construction: Vilyuchinsk 1 and 2, Beloyarsk 4, 5 and 6, Novovoronezh II – 1, 2, 3 and 4, Leningrad II – 1, 2, 3 and 4, Rostov 3 and 4, Baltic 1 and 2, Nizhny Novgorod 1, 2, 3 and 4, Tver 1, 2, 3 and 4, Tsentral 1, 2, 3 and 4, Seversk 1 and 2, Kursk II – 1, 2, 3 and 4, Kola II – 1 and 2, Dimitrovgrad, Smolensk II – 1, 2, 3 and 4, Zheleznogorsk, South Urals 1, 2, 3 and 4, Primorsk 1 and 2, Pevek, Balakova 5 and 6 and Sakha, reactor type PWR and FBR, installed electrical power: 52,760 MWe, annual interval for commissioning 2022 – 2030. Starting with 2030, for Russia, the weight of electrical energy produced in nuclear facilities will be approximately 25 - 30% of the total internal production, which will rise to 45 – 50% by the year 2050 respectively 70 – 80% by the end of this century.
- Brazil: facilities in development or under construction: Angra 3, reactor type PWR, electrical power installed: 1,245 MWe, start-up year 2020.
- India: facilities in development or under construction: Kakrapar (units 3 and 4), Kalpakkam, Kudankulam 1, Rajasthan (units 7 and 8), reactor type PHWR, PWR and FBR, electrical power installed: 3,907 MWe, start-up period 2015 - 2020.
- Ukraine: facilities in development or under construction: Khmelnitski (units 3 and 4), reactor type PWR, electrical power installed: 2,000 MWe, start-up period 2015 - 2016.
- Argentina: facilities in development or under construction: Atucha 2, reactor type PWR, electrical power installed: 692 MWe, start-up year 2013.
- Iran: facilities with operational activity: Bushehr 1, reactor type PWR, electrical power installed: 915 MWe, start-up year 2011.
- Finland: facilities in development or under construction: Olkiluoto (units 3 and 4) and Hanhikivi 1, reactor type PWR and BWR, electrical power installed: 4,900 MWe, annual interval for commissioning 2014 – 2020. Starting with 2020, the energy weight produced in nuclear facilities will be approximately 53% of the total internal production.

The only states which pursue the exploitation and processing of significant uranium resources to be further sold on the international market under the form of technical concentrates are: Kazakhstan, Canada and Australia.

We also find that a big part of the countries which will exploit significant uranium resources are located in areas with high probability for military conflicts (Iran, Africa) or have autocratic forms of government (Kazakhstan, Russia, Ukraine, Jordan, etc).

2. Equilibrium status at World level

Data and information previously presented (in a concise and synthetic manner) lead us to the following conclusions:

1. At world level, the Fukushima – Daiichi nuclear accident (units 1, 2, 3 and 4) did not generate a real local, regional or global phenomenon to reject or boycott capital investments in the field of nuclear-electric facilities.

This position expressed by the investors can be explained through the fact that the incident itself was not caused by technical or technological problems. It was caused by *unpredictable natural phenomena with catastrophic consequences:* earthquake followed by a devastating tsunami.

If the illogical and irresponsible solution to stop the nuclear-electric programs had been followed, than this wrong principle had to also be applied in the domain of tourism in the oceanic and marine beaches area (see: the earthquake followed by the tsunami in the coastal area of South-East Asia, which was responsible for 250.000 victims).

On the uranium market, the effect was short lived (approximately 3 months) and influenced the spot contracts. It was also responsible for the drop in the selling price of uranium under the form of technical concentrates from 169 $/kg U to 132 $/kg U.

2. Currently, 62 nuclear-electric facilities are in the construction phase, adding up to a total electrical power installed of *56,611 GWe*. (Official data communicated by the World Nuclear Association – WNA, on the date of 01.09.2012, see annex no. 1).

The construction of these facilities is *mostly possible in advanced states – highly industrialized states, which have strictly applied energy strategies* (objectives, deadlines, financing sources, annual and multiannual derivate policies, etc.) *for long periods of time* (30 to 50 years), such as: China: P_i = 26.83 GWe, Russia: P_i = 8.37 GWe, India: P_i = 3.97 GWe, South Korea: P_i = 3.64 GWe, Taiwan: P_i = 2.6 GWe, France: P_i = 1.6 GWe, etc:

The installed electrical capacity in new nuclear-electrical facilities that are in the construction or advanced development phase will increase starting with the year 2030 – compared with the year of reference 2010, with a percentage of 32% in the pessimistic version (LOW), respectively 95% in the optimistic version (HIGH).

The most significant increases with regard to the installed electrical capacities will be registered in highly industrialized Asian countries (China, India, Taiwan, South Korea) and in Russia, the increases being spectacular, up to 2 or 3 times.

Also, these countries dispose and *use their scientific, economical, military and informational capacities to insure their access to primary energy resources – uranium – for long periods of time.*

These states have leased mining perimeters in countries which have rich uranium deposits – especially on the African continent, which they exploit *intensively* (large processing quantities – millions of tons of minerals every year) and *extensively* (including low quality minerals – uranium content of 0.015%)

Through intensive exploitation, the life span of mining objectives is reduced (5-10 years). This way political and social problems can be avoided, problems that generally African states have and could affect the business itself.

On the other hand, extensive exploitation is especially achieved by applying technologies of acid chemical lixiviation and bacterial lixiviation in bulk or on site.

3. The annual uranium quantity required to fuel these new installed capacities is:

$$200 \text{ tU/GWe X } 56.611 \text{ GWe} \approx 11{,}325 \text{ tU/year}$$

The annual required quantity of uranium – according to the data from WNA, for operational nuclear power plants in the year 2011 was *68,971 tons*. (Official data communicated by the World Nuclear Association – WNA, on the date of 06.02.11, see annex no. 6).

Because in 2009 the necessary uranium quantity was covered to an extent of *76% from primary production and 30% from secondary resources and stocks, the problem of the primary energy resource – uranium – becomes a priority in the future context.* (Official data communicated by the World Nuclear Association – WNA, on the date of 07.2010, see annex no. 5, page 5).

The insufficiency of uranium originating from the primary production (mining exploitation) had been observed in the last years, respectively: 2005 – 65%, 2006 – 63%, 2007 – 64%, 2008 – 68% and 2009 – 76%. (Official data communicated by the World Nuclear Association – WNA, on the date of 01.09.12, see annex no. 7).

For countries members of the EU, the quantity of uranium needed to create nuclear fuel was provided by internal primary energy sources only in proportion of 3%.

The main problem in the near future is represented by the access to the primary energy resource. This problem shall extend for a long period of time. URANIUM is a GEORESOURCE for the following reasons:

- a perimeter located anywhere on the globe may become the *target of any highly industrialized state* (a developed country that has the economic, military and informational capacity to exploit it until exhaustion);
- uranium, as a primary energy resource, *stores a large amount of energy per mass unit, which makes it easy to carry anywhere in the world, regardless of the distance between the mining facility and the final consumer*;
- it can be *stored for very long periods of time (tens - hundreds of years*) under the form of technical concentrates of uranium or as raw minerals, if they are very rich (such as the Romanian deposits from Ştei exploited by Sovroms and stored unprocessed even today, a = 10 – 15% U);
- *the issue of nuclear energy security exceeds the local security area (delimitation) and/or regional security, and falls exclusively in the field of GLOBAL SECURITY; the delimitative notions of zonal and regional are exceeded, they transcend into global.*

4. *The Russian Federation, by means of the Master Energy Plan, postulated that nuclear energy will become of primary importance and predominantly internally*, and that its share will increase gradually each year: *2010 – 17%, 2030 – 25/30%, 2050 – 45/50%, 2100 – 70/80%.*

5. *Germany's current position to terminate the electricity produced in nuclear systems is not relevant* because at the moment it has just stopped work for outdated systems: Biblis (units A and B), Brunsbuttel, Greifswald (units 1, 2, 3 and 4), Grosswelzheim, Gundremmingen A, Isar 1, Juelich AVR, Kahl VAK, Karlsruhe MZFR, KNK – II, Krummel, Lingen KWL, Muelheim Karlich, Neckarwestheim 1, Niederaichbach, Obrigheim, Philippsburg 1, Rheinsberg KKR, Stade, THTR –

300, Unterwesser, Wurgassen, reactor type PWR, HTGR, PHWR, HWGCR, FBR and BWR, electrical power installed: 14,500 MWe. (Official data communicated by the World Nuclear Association – WNA, on the date of 01.09.12, see annex no. 2 and Annex no. 3).

6. The existence of small amounts of uranium in relation to the current and forecasted requirements have determined *the exploitation of uranium deposits with low metal content - 0.015 to 0.03% U by applying ACID DYNAMIC LIXIVIATION and BULK LIXIVIATION technologies*, such as: Salamanca (Spain), Berkeley and ENUSA mining operators, with an average in the deposit (c.m.z) of 0.036% U; Imouraren (Niger) AREVA mining operator, c.m.z. = 0.02% U, Rossing (Namibia), operator Rio Tinto, c.m.z. = 0.04% U, Langer Heinrich (Namibia), Paladin Energy mining operator, c.m.z. = 0.065% U; Akdal (Kazakhstan), the mining operator Kazatomprom, c.m.z. = 0.06% U; Munkuduk (Kazakhstan), the mining operator Kazatomprom, c.m.z. = 0.04% U, Inka (Kazakhstan), Cameco mining operator, c.m.z. U = 0.06%; South Inka (Kazakhstan), Uranium One mine operator, c.m.z. = 0.04% U, Mount Fich (Australia) mining operator Compass Resources, c.m.z. = 0.05% U; Mounth Gee (Australia), operator Marathon Resources, c.m.z. = 0.05% U, Prominent Hill (Australia), operator Oxiana, c.m.z. = 0.01% U, etc.

7. Sales prices of uranium as technical concentrates have shown a positive trend, a growth which consistent with the increased number of nuclear power capacities installed (under construction, in the operational phase) worldwide.

The year 2011 represented a confirmation of expectations regarding the possibility of exceeding the threshold of $100 per kilogram of uranium in the form of technical concentrates for multiannual contracts, while the demand for uranium recorded an upward direction, while maintaining a positive spread between this direction and the firm offer on the market.

Table 14 *Changes in the average selling price of uranium under the form of technical concentrates U_3O_8) between 2005 - 2010* [(1)]

YEAR	MULTI-YEAR CONTRACTS ($/kg U)	SPOT CONTRACTS ($/kg U)	NEW MULTI-YEAR CONTRACTS ($/kg U)
2006	51.85	72.54	NA
2007	55.32	164.43	NA
2008	63.76	159.56	114.41
2009	75.20	105.25	85.71
2010	83.27	107.30	105.46
2011	104.92	135.20	132.88

8. Forecasts made by the experts in the field for the period 2010 - 2035 relating to the international market of uranium used as fuel in nuclear power plants, are summarized in Table no. 15.

The data presented reveal that the mining production of uranium from the < $130/kg U production costs category fully meets consumer demand for nuclear fuel up to the year 2024 in an optimistic scenario, respectively the year 2021 for the pessimistic version.

Subsequently, this consumer need can be met only by drawing into the economic circuit of uranium deposits falling into the $130 – $260/kg U production costs categories.

However, if we were to consider the optimistic scenario for the evolution of new nuclear power plants to be commissioned by 2029, respectively an annual demand of more than 120,000 tons of uranium, the situation becomes complicated, meaning that the potential uranium resources barrier will exceed the psychological mark of the > $260/kg U cost category.

3. Equilibrium state for Romania

Given the defining features that characterize the uranium resources of Romania, the following conclusions are appropriate:

1. For a more objective assessment of the internal uranium resource potential, we considered the current international classification and definitions of the different categories of resources (according to the RED BOOK Uranium 2011).

As such, according to the reported data, the situation regarding domestic uranium resources with production costs below $130/kg U in the case of Romania is as follows:

- reasonably insured resources – approximately 3,100 t U (app. 0.09 % of the world total),
- deduced resources – 3,600 t U (app. 0.19 % of the world total),
- total identified resources – 6,700 t U (app. 0.12 % of the world total),
- prognosticated resources - 3.000 t U (app. 0.11 % of the world total),
- speculative resources – 3.000 t U (app. 0.08 % of the world total),
- total undiscovered resources – 6,000 t U 0.10 % of the world total).

Table 15 *Annual uranium production capacity (tU) until 2035 for resources identified with production costs below $130/kg U* [1]

Country	2011		2015		2020		2025		2030		2035	
	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II	A-II	B-II
Argentina	120	120	150	150	150	250	500	500	500	500	500	500
Australia	9,700	9,700	10,100	16,600	10,100	24,200	10,100	27,900	9,800	27,600	9,800	27,600
Brazil	340	340	1,600	1,600	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Canada	16,430	16,430	17,730	17,730	17,730	19,000	17,730	19,000	17,730	19,000	17,730	19,000
China	1,500	1,600	1,800	2,000	1,800	2,000	1,800	2,000	1,800	2,000	1,800	2,000
Czech Republic	500	500	50	50	50	50	50	50	50	50	30	30
Finland	0	0	0	350	0	350	0	350	0	350	0	350
India	295	980	980	980	980	1,200	1,000	1,600	1,000	2,000	1,000	2,000
Iran	70	70	90	90	100	100	100	100	100	100	100	100
Jordan	0	0	0	0	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
Kazakhstan	22,000	22,000	24,000	25,000	24,000	25,000	14,000	15,000	12,000	13,000	5,000	6,000
Malawi	0	1,000	1,270	1,270	1,425	2,525	0	0	0	0	0	0
Mongolia	0	0	0	500	150	1,000	150	1,000	150	1,000	150	1,000
Namibia	5,350	5,350	7,600	13,400	9,450	19,250	5,450	15,250	1,600	11,400	1,600	10,500
Nigeria	5,400	5,400	5,500	10,500	5,500	10,500	5,500	10,500	2,500	7,500	2,500	7,500
Pakistan	70	70	70	110	140	150	140	140	140	650	140	650
Romania	230	230	230	230	350	475	350	475	350	630	350	630
Russia	3,360	3,360	4,480	4,790	5,840	6,610	6,410	7,270	2,620	11,240	5,450	10,450
S. Africa	1,050	1,050	1,588	2,360	2,688	3,460	2,795	3,565	1,386	2,155	1,381	2,150
Ukraine	1,500	1,500	2,700	2,700	2,700	2,700	5,200	5,200	5,200	5,200	5,200	5,200
USA	2,040	2,040	3,400	6,100	3,800	6,600	3,700	6,500	3,100	5,600	3,100	5,600
Uzbekistan	3,350	3,350	4,150	4,150	4,500	4,500	5,000	5,000	5,000	5,000	5,000	5,000
TOTAL	**73,305**	**75,090**	**87,488**	**110,310**	**95,451**	**133,570**	**83,975**	**125,050**	**69,026**	**118,625**	**64,831**	**109,460**

2. With the exception of the geological potential of internal uranium resources in the context of increasing technological consumption and sales price worldwide, secondary (unconventional) resources should be considered. These resources, due to the current and future technical/technological progress, may now be valuable from an economical point of view.

3. Resizing the Romanian geological potential for uranium and taking into account the current level of knowledge, reviewing all of these resources that can be found in different stages of research and localization leads to the following values:
- reasonably insured resources – assimilated as measurable resources, 5,620 t U (4,000 t U appreciated as potentially recoverable);
- Deduced resources – assimilated as indicated resources, 7,570 t U;
Total identified resources – 12,830 t U.
- Prognosticated resources – app. 12,000 t U;
- Speculative resources – app. 16,000 t U;
Total undiscovered resources – app. 28,000 t U.

It is mentioned that the assessment (estimate) of undiscovered resources is relative, this assessment representing a comparison and interpolation of the domestic situation reported worldwide.

4. Uranium deposits in Romania have some geological and mining features which are disadvantageous for the evaluation of reserves and exploitation conditions (irregular development, intense tectonization, dispersed mineralization, high operating depths, large variety of gangue minerals, etc.).

5 The evaluation of recoverable resources/reserves from the total geological resources require feasibility studies (with research studies and industrial conditions) or prefeasibility studies to establish the viability of technical and economic recovery of each deposit, knowing that in given circumstances, not all highlighted geological resources may become exploitable resources.

6. From the assessment of the geological potential we see that the uranium deposit Crucea - Botuşana, currently in exploitation, is the most studied and known, but its development prospect is limited to a time horizon of 5-6 years.

7. The Tulgheş – Grinţies deposit, in the same metallogenetic province of the Carpathians, is rated as the most important uranium deposit at this moment, with a global potential of 6,000 t U, but potentially valuable resources are app. 50% of the total.

8. The Eastern Carpathians metallogenetic province requires further detailed geological investigations for other mining objectives in the area. Abandoned due to lack of funds, they may represent additional sources for compensating the depletion of the Crucea – Botuşana deposit.

9. The mines opened for the uranium deposits in Banat, exploited for nearly 30 years, are being closed by means of underground flooding (-700 m).

The abandoned reserve of about 1,000 t U/year reasonably insured resources and deduced resources will be difficult to be drawn back within the economic circuit, but not impossible.

10. A similar situation is represented by the Avram Iancu deposit (Apuseni Mountains), which has an abandoned reserve of app. 550 t U; this is poor and dispersed over multiple horizons (levels) more or less accessible.

11. In the Apuseni Mountains there are some uranium deposits with potential resources, that could be utilized in the future (Rănuşa, Arieşeni – Valea Galbenă, Padiş, Milova), totaling about 3,900 t U and a potential that is two times that of projected resources.

For these deposits geological exploration and industrial/experimental exploitation works have been abandoned and activities have been started in order to close the facilities and clean the environment in the area. Normally these deposits should be preserved and feasibility studies should be run regarding the assessment of real capitalization possibilities and further geological research.

12. Following the positive development of the uranium market, the introduction into the economical circuit of secondary uranium resources becomes realistic. The exploitation of these resources has been prohibitive until now.

In Romania a series of secondary or unconventional uranium resources identified can be taken into consideration, as follows:

● mining dumps and the Cetățuia II tailings pond, which have weak radioactive activity (below 0.03% U). According to the synthetic inventory presented in table no. 3 and the estimated uranium content, the total amount of uranium in all solid tailings is estimated to be around 3,190 – 5,120 t U;

● mine waters and technological waste waters (Plants "R" and "E") are also a secondary resource for recoverable uranium. The performed analysis reveals that the estimated potential of uranium in the mine water is approx. 16 – 20 t U/year, and the pore water of the tailings from the tailings pond Cetățuia II (sections 1 and 2) from Feldioara contains an amount of approx. 24 – 26 t U;

● worldwide, one of the most important secondary uranium resources is represented by natural phosphates (0.01 – 0.02% U). For Romania, according to the country's phosphate fertilizer industry development, this secondary resource can also be taken into consideration;

● another secondary uranium resource that captured the attention of worldwide communities in recent years is the ash produced by power plants; technological research conducted demonstrating the possibility to recover uranium through adequate technologies with costs that can cover the current price of uranium. Romania produces annually about 8 – 9 million tons of ash which are land filled in the vicinity of power plants. Capitalization of uranium deposited in these landfills involves the development of specific studies to confirm the contents of uranium and subsequently identify opportunities for its economic recovery.

13. Domestic uranium resources stationed in underground deposits can provide sufficient nuclear fuel for the two nuclear energy groups at Cernavodă for the next 50 years.

The nuclear power plant at Cernavodă is equipped with two reactor groups, more exactly:

- Group I (G.I.) - commercially operational since 02.12.1996, with a projected capacity of 706 MWe, 650 MWe net capacity, system CANDU 6, PHWR technological process, normal operating period from 1996 to 2025 (expandable by 10 years, until 2035), annual uranium consumption need – 92.4 tons;

- Group II (G.II) - commercially operational at 31.10.2007, with a projected capacity of 706 MWe, 650 MWe net capacity, system CANDU 6, PHWR technological process, normal operating period from 2008 to 2037, annual uranium consumption need – 92.4 tons;

The forecasted need until the decommissioning of the two nuclear energy groups is approximately. 4,500 tons of uranium in the form of synthesizable uranium dioxide powder, as follows:

(13 + 10) $\text{years}_{G.I.}$ x 92,4 tU/year + 25 $\text{years}_{G.II.}$ x 92.4 tU/year = 4,435.2 tU

Conclusions

In these circumstances *Romania's strategic objectives* to ensure (maintain) access to the primary energy resource – *uranium* – is as follows:

i. Exploitation until depletion of resources, with accepted efficiency conditions, of the uranium deposits at Crucea – Botușana (Suceava county);

ii. Building a new processing plant for uranium minerals – TG Plant in Feldioara, Braşov county;

iii. Research, design and operation of a facility for processing and preparation of mining waste products from mining dumps and from the Cetățuia II tailings pond;

iv. Building a new uranium minerals refinement plant – YC Plant in Feldioara, Braşov county;

v. opening and exploitation of the uranium deposit in the Eastern Carpathians (Primatar I Primatar II Bradu, Prisecani and Zone V).

Points i, ii, iii, iv and v are elegant solutions to an engineering problem using a minimal amount of technology for Romania's strategic objectives – to ensure access to primary energy resources of uranium.

In order to achieve these strategic objectives, the Compania Națională a Uraniului SA – as a single entity that owns and operates uranium deposits in Romania, must focus its future development policy (for the next 5 years) on the following:

i. Given the expected liberalization of the electricity market, it is essential to create a new energy entity, an organization of national strategic interest, which will include – preceded by a prior restructuring: S.C. Compania Națională a Uraniului S.A., S.N. Nuclearelectrica S.A. (including F.C.N. Pitești), R.A.A.N. Halânga and part of research institutes and design teams in the fields of geological exploration, mining, mineralurgical processing (including hydrometallurgical) and energetic research with applications in nuclear energy.

This entity will lease and manage in its own interest – for prospecting, geological exploration and exploitation – all domestic perimeters that include resources and reserves of uranium and rare/disperse metals – uranium, niobium, tantalum, yttrium, beryllium, lithium, tungsten, titanium, etc. (these were previously investigated in the prospecting and geological exploration phases with funding from public money).

The liberalization of the electricity price will avoid situations such as: S.N. Nuclearelectrica S.A. makes profits, and C.N. a Uraniului S.A. operating at a loss.

Balancing the system is mandatory for the route Mine – Processing Plant – Refining Plant – Fuel Manufacturer – Heavy Water Production – Energy production.

All these components of the Romanian nuclear energy system are subject to the "matrioska dolls" paradigm – that is, things being made up of smaller things.

i. Restructuring the National Uranium Company involves the following steps:

ii.1. Urgently switching to exploitation of the mining perimeters Primatar I and II Primatar which include rich reserves of uranium mineral – at an average of 0.25 to 0.3% metal in the upper area of the deposit.

Commissioning of these two mines from the Tulgheş – Grinţies deposit is a favorable investment since opening, training and exploitation expenses are minimal (referring primarily to the mining works needed for opening and the access roads) and the area is rich in metal which provides a positive cash-flow. The commissioning duration is about 12 to 18 months. The required initial investment is about 5 – 7 million euro.

ii.2. Switching the processing plant "R" from the flow of alkaline lixiviation to the flow of acid lixiviation flow, which allows:

- higher extraction efficiency: from 97 to 98.5%, compared to the 80 – 85% which is currently achieved, in conjunction with the presence of sulfides in the primary mineral ore at Primatar I and II,
- ensuring the continuity in the mineral supply chain at processing plant "R" with low grade ore from the tailings pond (preparation technological tailings) - includes 750 – 800 tons of uranium at an average grade of 0.02% U (comparable with surface mines exploited internationally by acid lixiviation and bacterial lixiviation) in tandem with ore from Primatar I, II and Primatar Crucea - Botuşana,
- the dynamic acid lixiviation is the only method that allows harnessing technological tailings from the tailings pond given the degree and the way of association of uranium minerals and sterile minerals, especially those of bituminous nature (anisotropic solid hydrocarbons), which are unresponsive to alkaline attack and which generate important losses,
- the closure of Cetățuia II tailings pond, once the uranium is exhausted from this potential resource (work will continue in tandem: compartment 3 in depositing – compartment 2 in operation and then compartment 2 in depositing – compartment 1 in exploitation, later on compartment 1 will remain in depositing),
- the closure of the tailings dumps in the Ştei area (Băița Plai) encompasses approximately 1,593 tons of uranium at an average grade of 0.035% U, through relocation and encapsulation in the area immediately adjacent – preceded by a radiometric sorting of the poor ore deposited in a mix with mine tailings in the operational phase,
- bringing into the economical circuit of the targets that have uranium reserves associated with sulfides (Grădiştea Mountain, Padiş Rănuşa, Budureasa, Pietroasa, Arieşeni, Valea Vacii - Valea Leucii, and so on).

The commissioning duration is about 12 to 18 months. The investment for retooling is approximately 10 – 13 million Euros (of which the cost of radiometric sorting station is app. 2,5 million euro).[4, 5, 6]

ii.3. Continue with the transition to phase PT + DTAC + AC of the feasibility studies: the mining operation Tulgheş – Grinţies, the TG plant in Feldioara and the YC plant in Feldioara.

These will provide the nuclear fuel needed at Cernavodă power plant until 2035-2037.

ii.4. Continue the sustainability investments for managing the Băița (Bihor county) national radioactive waste repository.

iii. The intentions of the Romanian state to lease deposits of uranium abroad (Jordan, Kazakhstan, etc.) – action carried out during 2009 - 2011 in order to exploit and later transport into the country the resulted uranium technical concentrates. This action faced two major problems, which have proven to be unsurpassable until this day:

- uranium deposits with uranium content which can be commercially exploited and which allow access to them (it is possible to achieve an infrastructure with reasonable investment) were leased by leading operators worldwide (Areva, Cameco, Rio Tinto, BHP Billion, etc.);
- deposits free of encumbrances (concessions) are either poor or associated with phosphates and are thus extremely difficult to process.[7]

The electricity produced in nuclear-energy type systems (reference to Cernavodă nuclear power plant, energy groups 1 and 2) will represent for Romania – in the next 25 years, ***a secure, sustainable and competitive source of energy.*** This will allow Romania to have an offensive, efficient and equitable position within the local area (border) and regional community.

Uranium – as a primary energy resource, may represent a protective shield for Romania in view of maintaining bilateral energy relations between some Member States (Germany, Austria, etc.) and supplier or transit countries (Russia), which determine a fragmentation of the EU internal market and does not strengthen the EU's energy supply and enhance its competitiveness.

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