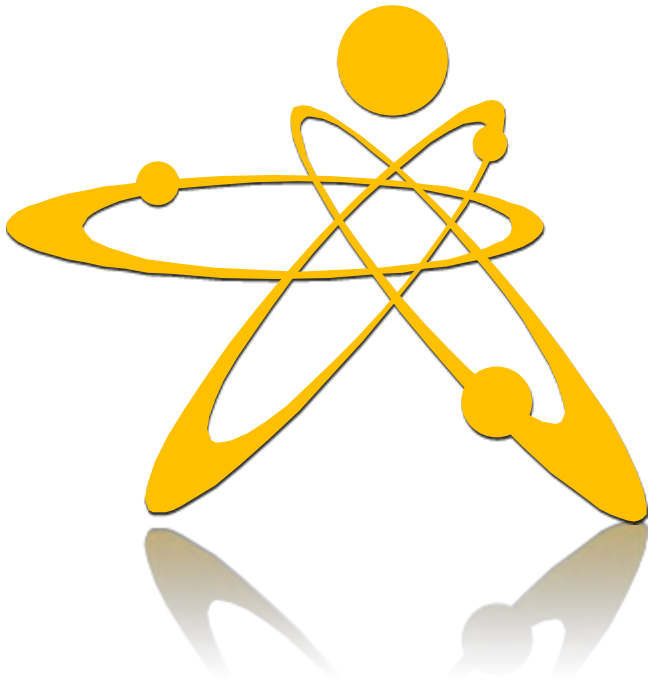


NUCLEAR POWER PROGRAM IN THE REPUBLIC OF KAZAKHSTAN

2013

INTRODUCTION

The idea nuclear power production in Kazakhstan has a long term of history. It was discussed from the times when our country refused from nuclear weapon testing and NPP in Aktay (West Kazakhstan) with reactor BN-350 was locked, but the real steps to the introduction of the first in independent Kazakhstan NPP was undertaken in 2006 when the President in his annual message had announced the determination to develop our own nuclear power production.

Since then a big preliminary work was carried out for feasibility study of NPP construction, its siting recommendation, public hearings and such on. About a month ago our President gave the direct order to our authorities to make a decision about the place of future nuclear power plant location and technical characteristics of the nuclear power station

BACKGROUND FOR THE NUCLEAR POWER DEVELOPMENT IN KAZAKHSTAN

1. Kazakhstan possess by 19% of the world uranium explored reserves;

2. Availability of the developed uranium mining and processing industry.

3. Strategy of NAC “Kazatomprom” determined to the arrangement of full nuclear fuel cycle will give an opportunity to lower power tariff

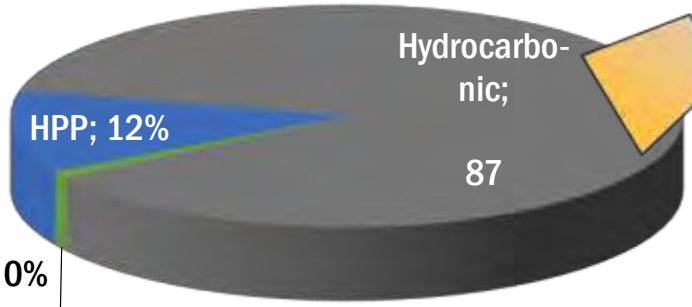
4. Availability of highly qualified personnel of BN-350 reactor and scientific base with three operating reactors.

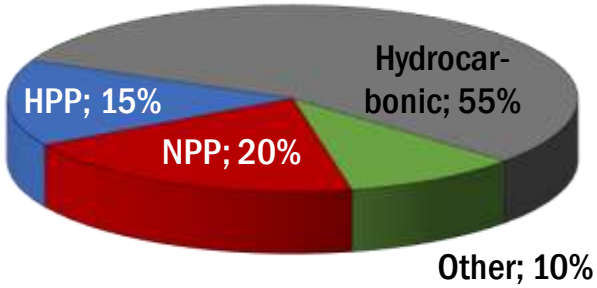
5. National system of nuclear and radiation safety, integrated with IAEA

6. Legislation and regularity base for all the main aspects in the field of peaceful use of nuclear energy.

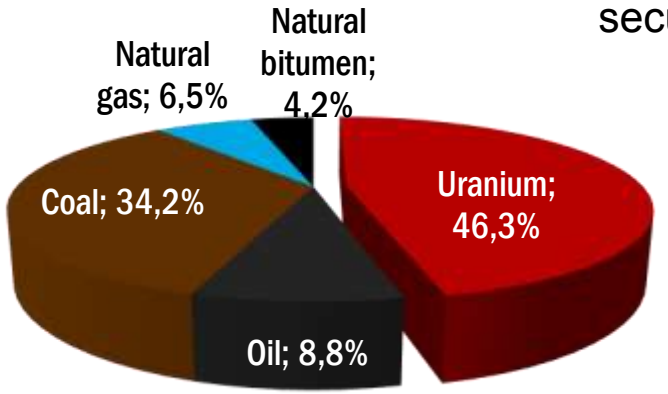
Energy Structure of Kazakhstan

The current state
of Kazakhstan power industry





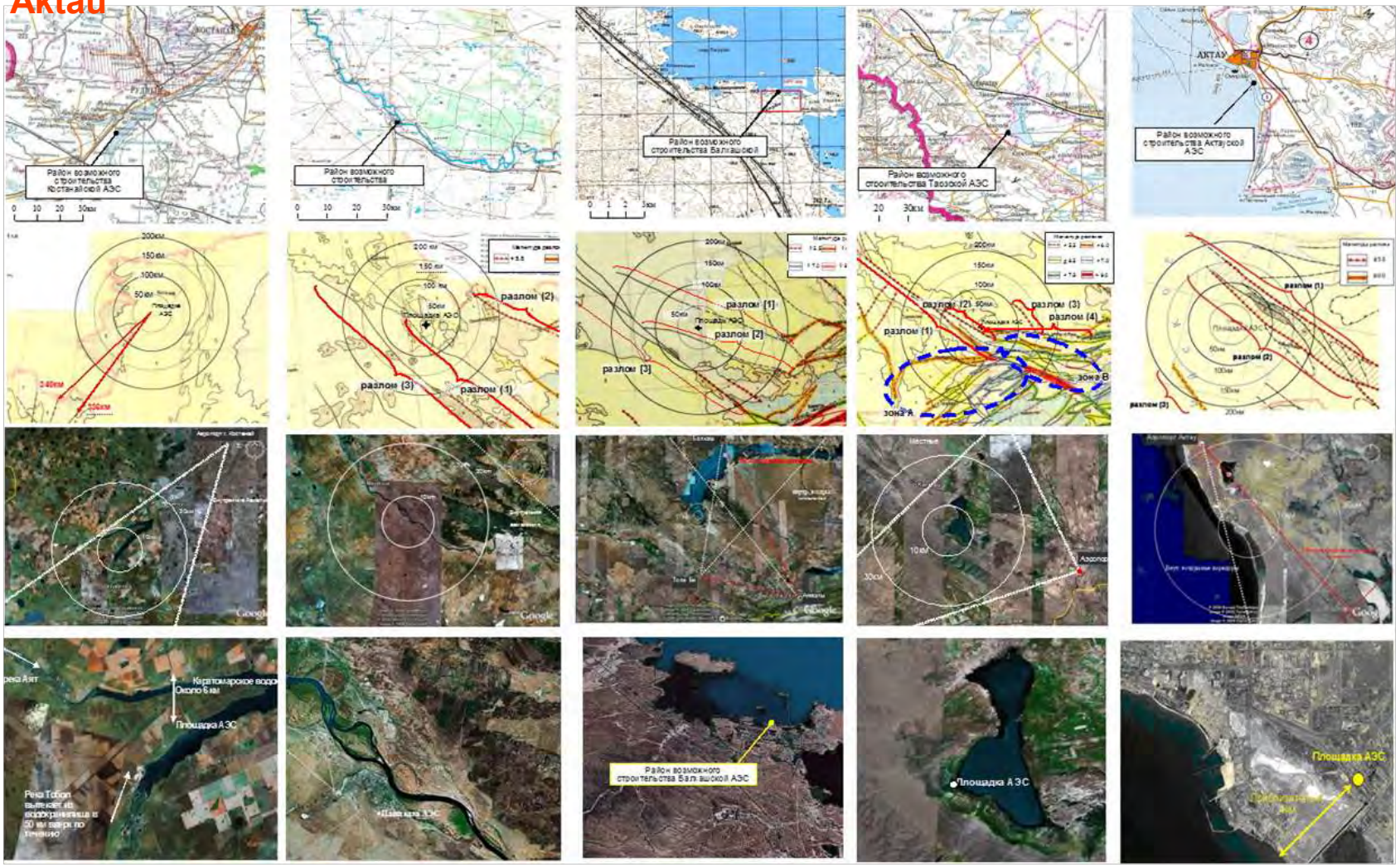
"Ideal" option of the power industry
structure in terms of diversification
of energy sources and energy
security of the State



Energy resources in Kazakhstan
in terms of standard fuel

Areas for Future Construction NPP as Basic Sources of Electricity

Kostanay Kurchatov Balkhash Taraz Aktau



Forecast of Electrical Power Balance

Energy bands of Kazakhstan	Maximum initial power, MW			
	2015	2020	2025	2030
North Kazakhstan (Kostanay)	0	1000	1500	2000
East Kazakhstan (Kurchatov)	0	600	600	900
South Kazakhstan (Balkhash)*	(1320)	(2640)	(2640)+1500	(2640)+2500
West Kazakhstan (Aktau)	600	600	900	1200
The total need for new sources of initial power	600	2200	4500	6600

*) The table (in brackets) shows the rates of the initial power input in the South Kazakhstan region through the construction of two modules of the Balkhash coal-fired plant thermal plant with total capacity of 2640 MW with the commissioning of the first module capacity 1320 MW (2 × 660 MW) on the level of the year 2015, the second module of the same capacity in 2018 -2020.

Forecast of Electrical Power Balance

In 2008-2009 RSE NNC PK implemented feasibility study (FS) in support of the nuclear power plant construction in Kazakhstan.

According to the results of feasibility study on the basis of the electric power balance in Kazakhstan and forecast of the electric networks development by 2030 the possibility to use NPP as a source of initial power is showed:

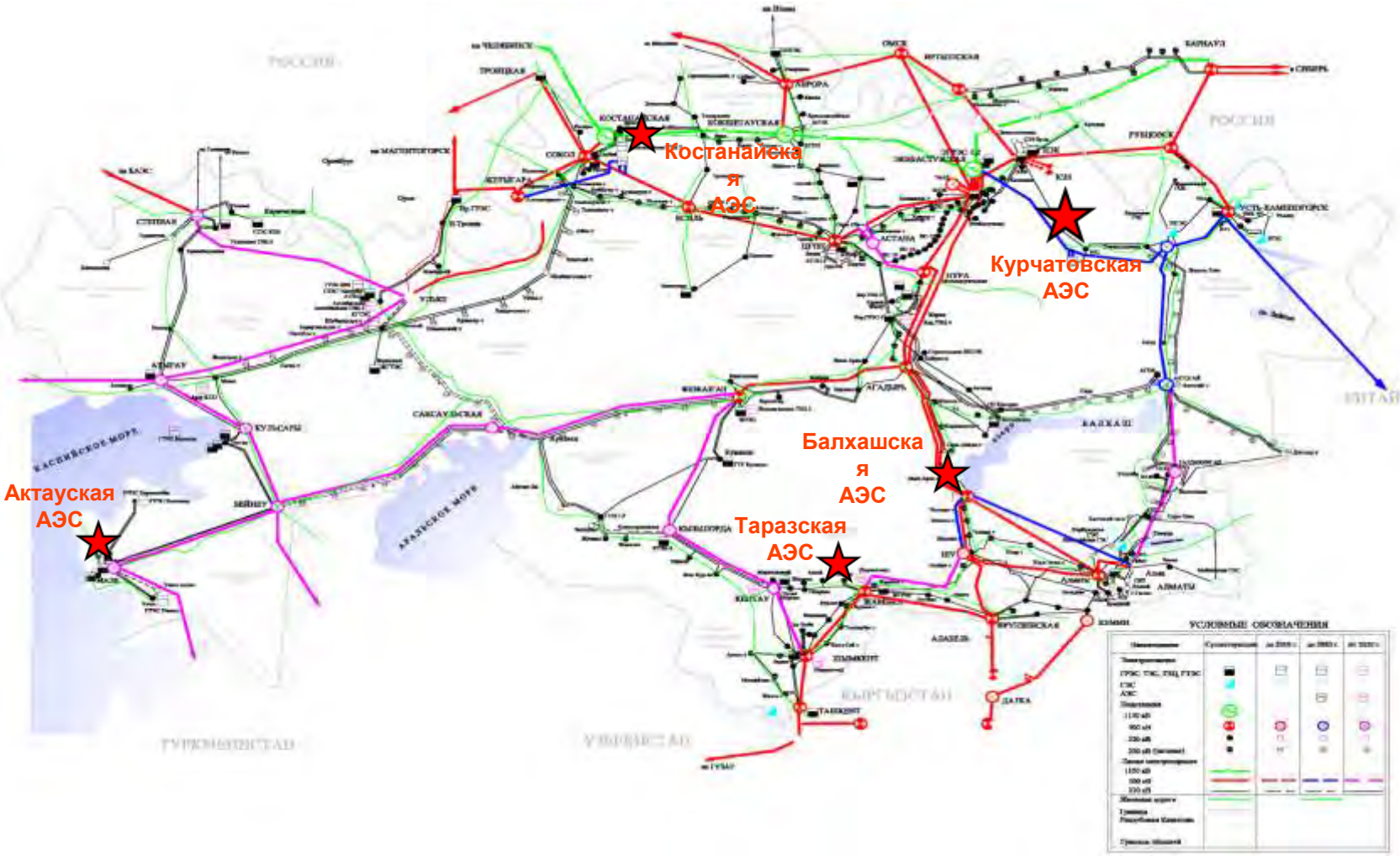
at the first stage – with water-moderated tank-type reactors (APWR, ABWR) of Generation III, III+ .

in the long term – with Generation IV reactors (fast reactors and high-temperature gas-cooled reactors) .

It is preferable to build NPP in the nodal points of the power system, near big cities and water sources, where it is reasonable to create of sources of initial power based on the unified NPP units with unit capacity of 600 MW, and up to 1000 MW under conditions of the Kazakhstan energy sector modernization.

In terms of operating parameters of electrical grid economy in the western zone of Kazakhstan power system it is reasonable to construct NPP with capacity up to 300 MW.

Areas for Future Construction NPP as Basic Sources of Electricity



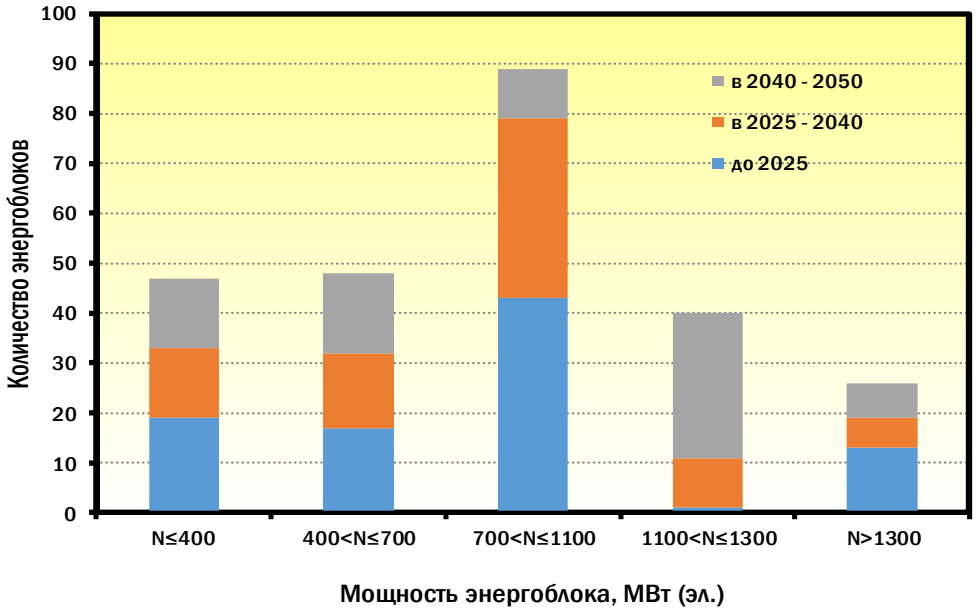
Schematic map of the electricity networks 220 kV and above of Kazakhstan unified electric power system for the period till 2030. (North, East, Central and South Zone)

NPP Attractive Projects

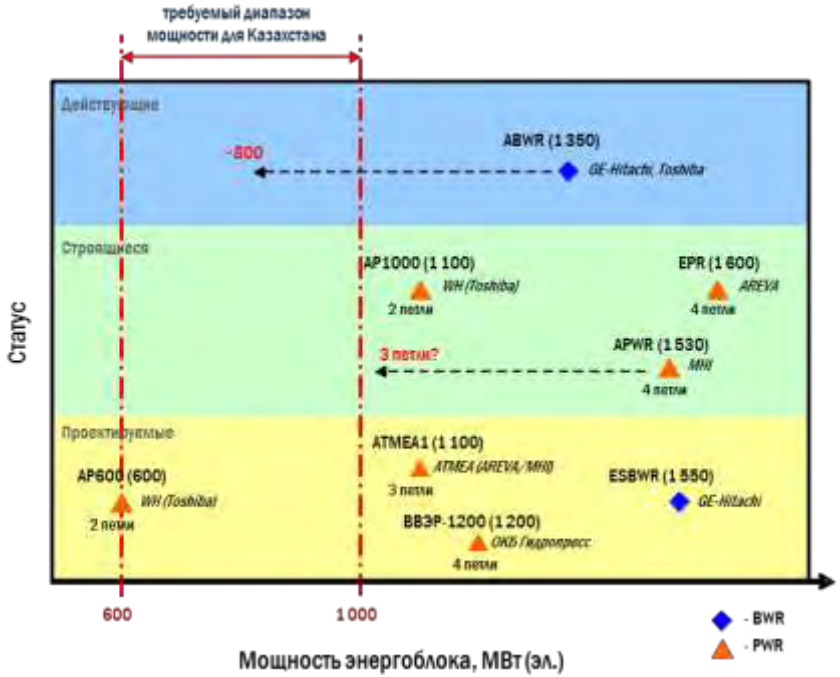
In Kazakhstan the construction of modern Generation III, III + reactors, which will be ones of widely used in the world (in the range of 600-1000 MW) will effectively apply international operating experience throughout the entire life cycle of NPP (60 years).

There are virtually no modern NPP projects in the range of the power required for Kazakhstan.

Rational solution of the problem is to develop a suitable option on the basis of existing NPP projects of big power.



The demand for new energy units of the light-water reactors of different power



Current status of Generation III and III+ LWR projects

Present-day Projects of NPP (Generation III, III+)

PARAMETERS	BWR-300	ABWR	EPR	APWR	AP-600	AP-1000
Electric capacity, MW	295	1350	1600	1538	600	1150
Company, country	Experimental design bureau of machine building, Russia	GE, Hitachi, Toshiba USA, Japan	AREVA NP, France	Mitsubishi Heavy Industries, Ltd.	Westinghouse, USA	
Project status	Research work	Research work	Research work	Conceptual design	Designed and certified by the U.S. Nuclear Regulatory Commission (NRC)	
In operation	No	Japan	No	No	No	No
Under construction	No	Japan, Taiwan	Finland, France	It is considered the construction of three units in Japan and one unit in the USA	No	China
Other characteristics	Suitable for isolated energy bands (Aktau)	The ability to scale with power reduction to 960 and 650 MW	The ability to scale with power reduction to 1000 and 600 MW	The ability to scale with power reduction to 1000 and 600 MW	Can be used in the power system of Kazakhstan	

ABWR1350 is the solely Generation III+ reactor being in commercial service from November, 1996. ABWR construction solves the problem of the scaled power reduction by the relatively simple means. Hitachi и TOSHIBA имеют наработки по проектам ABWR960 и ABWR650.

Estimation of the Construction and Electricity Prime Cost

Terms of payment: loan rate – 4%, Availability Factor – 85%, accounting period – 40 years. The real cost of NPP construction may differ from the values obtained in the refinement of the costs associated with the use of local materials, labor, and in accordance with the specific conditions of construction sites.

The calculated values of the cost of electricity production mainly correspond to the conditions of Kazakhstan using OECD data on operating costs.

ABWR	ABWR (960 MW)		ABWR (650 MW)	
	$ million	$/kW	$ million	$/kW
Construction cost	2991	3116	2583	3974
Electric power production prime cost, cent/kW	3,1		3,73	

APWR	APWR (1000 MW)		APWR (600 MW)	
	$ million	$/kW	$ million	$/kW
Construction cost	3167	3167	2698	4497
Electric power production prime cost, cent/kW	3,13		4,11	

EPR	EPR (1000 MW)		EPR (600 MW)	
	$ million	$/kW	$ million	$/kW
Construction cost	3224	3224	2791	4652
Electric power production prime cost, cent/kW	3,17		4,21	

AP600/1000	AP1000 (1200 MW)		AP600 (600 MW)	
	$ million	$/kW	$ million	$/kW
Construction cost	3484	2903	2681	4469
Electric power production prime cost, cent/kW	2,94		4,09	

CONCLUSION

Introduction of nuclear power production in the Repubic of Kazakhstan is a real process now.

Commission will make offers for the government about future station location and its configuration in March 2013. The process of vendor selection will take about two years: one to prepare documents for tender and the next for tender.

It is supposed that the first block of nuclear power plant will be put into operation up to 2020.

The development of nuclear power sector will lead to the improvement of industrial level and intellectual potential of our country.