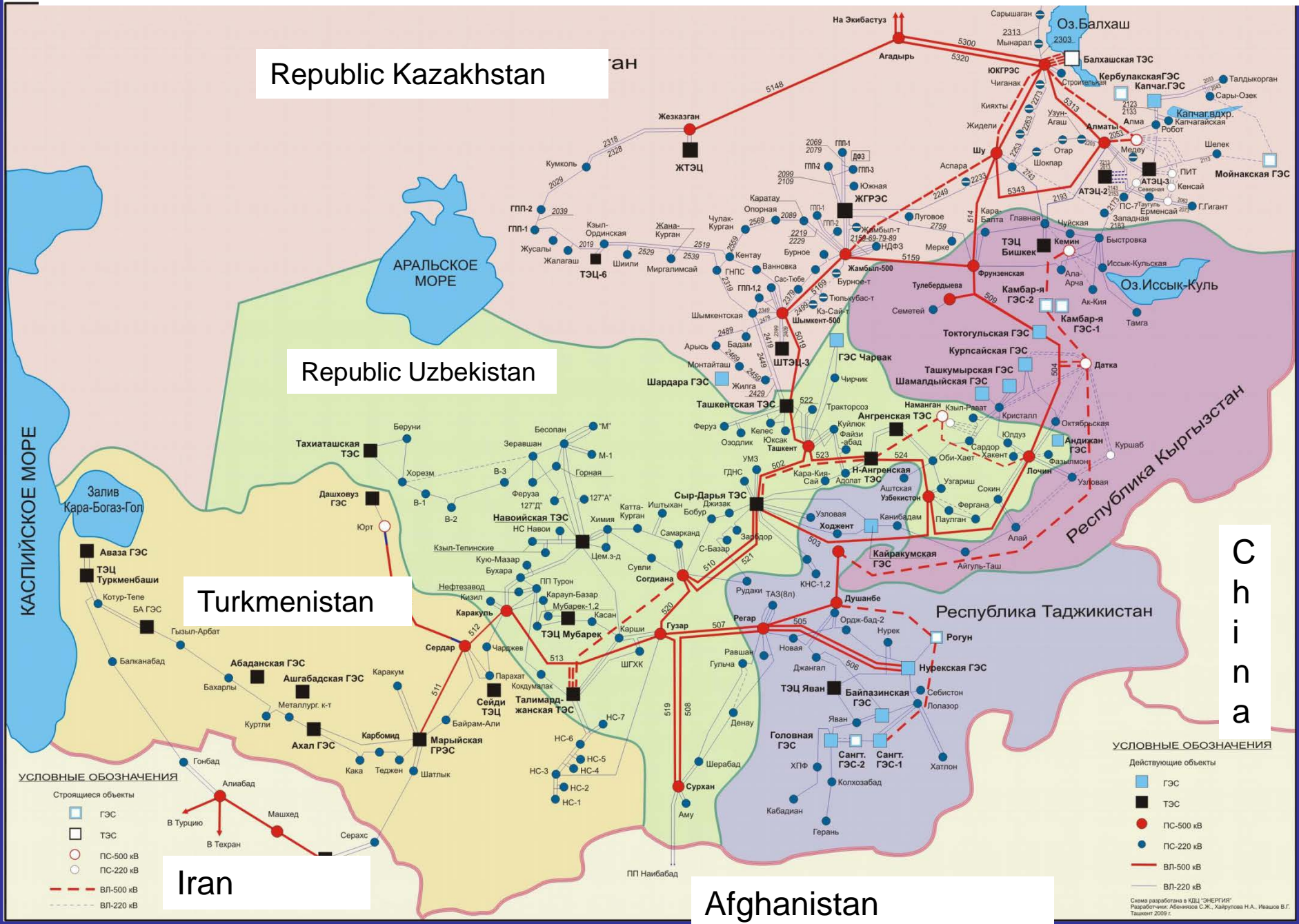


Coordination and dispatcher center "Energy"

**Issues of
power exchange and development of
regional electric power trade
in
CENTRAL ASIA**

**Director of CC «Energy» H. Shamsiev, PhD
September 2013**

Map of main power lines of 220-500 KWT in Central Asia with prospect for 2020



C
h
i
n
a

УСЛОВНЫЕ ОБОЗНАЧЕНИЯ

Действующие объекты

- ГЭС
- ТЭС
- ПС-500 кВ
- ПС-220 кВ
- ВЛ-500 кВ
- - - ВЛ-220 кВ

Схема разработана в КИЭ "ЭНЕРГИ" / Разработчик: Абеникис С.Ж., Хайрулова Н.А., Исаков В.Г. / Ташкент 2009 г.

- In Soviet times, the power system of the Central Asian Republics (CARs) were designed with the need to take advantage of available energy resources and seasonal energy interchanges between the countries.
- In the regional Integrated power system built on 220-500 kV power grids, the power stations in Kazakhstan, Turkmenistan and Uzbekistan have been combined with hydropower plants in Tajikistan and Kyrgyzstan.

- It allowed Tajikistan and Kyrgyzstan to export electricity in summer, when their hydro energy systems work at maximum capacity, and import electricity in winter, when there is a shortage of energy.
- Water discharge from hydropower stations in Tajikistan and Kyrgyzstan were coordinated in accordance with the primary objective to meet the irrigation needs of the downstream countries.

- Electrical power systems modes were built on the basis of the need for the above-mentioned relationship of energy and irrigation.
- Thus, everything was pre-planned. In the energy sector the above was expressed in the plans of every energy unit with regards to generating and consuming of power (for every grid, for regional power centers, power plants, power companies, etc.). These plans were monitored and should have been strictly observed.
- Power trade was carried out not only between the Republican power systems in general, but also between individual power centers, provided that tariffs were various, they were not contractual and were established "at the top level".

- In accordance with the plans of the Republican power system, the dispatcher plans were made not only for power plants, but also for inter-system overflows, provided that planning should have been carried out with a view of optimization of the power systems in general.
- Trade volumes were determined on the basis of technical flows between power grids.
- The above is illustrated in the following table.

In-country overflows of power for 1990 in CAPS

1990 год		Power systems in CAC													Всего:
		Республика, получающая электроэнергию													
		Таджикская ССР		Узбекская ССР		Казахская ССР			Туркменская ССР			Кирг ССР			
Сев.Тадж	ДВЭС	УзССР	Сурхан	КзССР	Чу, Курдай	Джамбул	Ташауз	Чарджоу, Керкичи	Гаурдак	р-н Мары	Талас, Кияхты	р-н Сулюкты			
Республика, передающая электроэнергию	Uzb SSR	3814.2	112.7			8139.8			658.2	288.1	166.1	0.7			13179.8
	Tadj SSR				2344.2									324.1	2668.3
	Kyrg SSR			2383.6			210.4								2594.0
	Kyrg SSR, Frunze							487.1							487.1
	Turkmen SSR			6066.1											6066.1
	Kazh SSR												227.4		227.4
	Kazh SSR (Chardaryn)			309.9											309.9
	DPP)	3814.2	112.7	8759.6	2344.2	8139.8	210.4	487.1	658.2	288.1	166.1	0.7	227.4	324.1	25532.6

- The table shows that in addition to the basic Republican power system there are some separate power centers available, which, without any direct connection to the main power grid, had nothing to do but to buy power from the neighboring power systems.

- Since independence in 1991, the countries of CAR initiated the policy of energy "self-sufficiency".
- Growth of power tariffs led to the fact that for the countries that have reserves of energy resources it has become more profitable to export fossil fuels outside of the CAR. This led to violation of the existing schemes of energy exchange.
- Destruction of the unified banking system and introduction of national currencies led to the need, at the initial stage of reforming economies, of using barter energy exchange.

- The consequence was that, instead of technical intersystem flows, the concept of commercial flows had to be introduced, as a result of balancing the technical flows.
- Function of calculating the volumes of commercial flows was assigned to the TAC Central Asia (now the CDC "Energy").
- As a result, the volume of electricity trade declined from 25 GWh in 1990 to 2.3 GWh in 2010. It should be clearly understood that this reduction occurred in the first place with the transition to a new system of calculation of the volume of energy exchange (from technical flows to commercial flows).
- In parallel with the fact that due to the mentioned above reasons of "self balancing" the process of reducing the cross-border power trade was going on, dynamics of which can be seen from the following tables.

		Power systems of CA countries					млн.кВтч
		Импорт					
1995 год		Республика Казахстан	Республика Кыргызстан	Республика Таджикистан	Республика Узбекистан	Туркменистан	Всего:
Экспорт	Республика Кыргызстан	786.6		69.1	928.7		1784.4
	Республика Таджикистан	309.4			296.1	31.8	637.3
	Туркменистан	1682.3		101.3			1783.6
	Республика Узбекистан	432.2	412.5	1128.6		315.7	2289.0
	Из Северного Казахстана	1100.7					1100.7
	Из Казахстана (Атырауэнерго)				7.2		7.2
Всего:		4311.2	412.5	1299	1232	347.5	7602.2

		Power systems of CA countries					млн.кВтч
		Импорт					
2000 год		Республика Казахстан	Республика Кыргызстан	Республика Таджикистан	Республика Узбекистан	Туркменистан	Всего:
Экспорт	Республика Кыргызстан	1252.9		154.4	1925.6		3332.9
	Республика Таджикистан		125.7		243.9		369.6
	Туркменистан	34.8		818.7	67.8		921.3
	Республика Узбекистан		194.6	728.8		32.5	955.9
	Всего:	1287.7	320.3	1701.9	2237.3	32.5	5579.7

млн.кВтч

	2005 год	Энергосистемы государств Центральной Азии					
		Импорт					
		Республика Казахстан	Республика Кыргызстан	Республика Таджикистан	Республика Узбекистан	Туркменистан	Всего:
Экспорт	Республика Кыргызстан	2668.1		230.1			2898.2
	Республика Таджикистан	68.5	3.5		683.5		755.5
	Туркменистан						0.0
	Республика Узбекистан			814.9		0.4	815.3
	Всего:	2736.6	3.5	1045	683.5	0.4	4469

млн.кВтч

	2010 год	Энергосистемы государств Центральной Азии					
		Импорт					
		Республика Казахстан	Республика Кыргызстан	Республика Таджикистан	Республика Узбекистан	Туркменистан	Всего:
Экспорт	Республика Кыргызстан	1799.7		17.5	8.6		1825.8
	Республика Таджикистан		96.6				96.6
	Туркменистан						0.0
	Республика Узбекистан		13.3	320.8			334.1
	Всего:	1799.7	109.9	338.3	8.6		2256.5

- In turn, this has led to the fact that in Tajikistan the cases of non-performing water discharges have become frequent in summer due to lack of power demand and due to limited capacity of water reservoirs, and in winter in Tajikistan and Kyrgyzstan there were shortages of electric power.
- Striking example of this situation were power shortages in the winter in dry years, especially in 2007 and 2008.

- Reducing electricity interchanges combined with decline of mineral energy resources supply led to the fact that hydropower in Tajikistan and Kyrgyzstan made transition from irrigation mode to energy mode with prevailing power generation in winter.
- Since water is needed for irrigation in summer, this has led to the problems associated with performance of reservoirs.
- This resulted in the situation in which some countries produce electricity using fossil fuels, instead of implementing of mutually beneficial imports of excessive electricity from neighboring countries generated by renewable water resources.

- Transition from technical flows to commercial flows has led to the need to introduce one more new concept, which was not in existence previously, which is "**transit of electricity**."
 - In the United Energy System of Central Asia (CAPS), which used to worked in stand-alone mode, it was necessary to urgently develop the methodology to determine the volume of power transit.
 - Developed in CAPS and currently effective methodology has played an important role in putting in order of the relationship between energy systems, but it is not perfect and has flaws, which, as experience has shown, have been creating difficulties for implementation of the power exchange through the network of third-countries.

- In particular, the methodology involves obtaining of permits for transit of electricity and the matter is sometimes associated with other non-technical problems.
- As a result, there have been cases where contracts signed for supply of electricity did not work.
- Thus, transit difficulties have led to the situation that in 2003 the Turkmen power system without having markets for power export in CAPS, left it and began to work with the power system of Iran.

Is it possible to restore the power trade in the region at the same level and what is to be done for that?

- At present, the power systems of South part of Kazakhstan, of Kyrgyzstan and Uzbekistan, operate within the CAPS in parallel with the Unified Energy System of Russia and CIS through the energy system of Kazakhstan
- At the end of 2009, due to the problems with maintaining the balance of power, the energy deficient Tajik energy system was separated from the CAPS and currently works in isolation.
- Some separate, passive (without generation) parts of the power system in Afghanistan, which are connected, respectively, to the grids of Uzbekistan, Tajikistan and Turkmenistan, operate within the CAPS grids based on the so-called island schemes.

- Currently, with the support of international donors, the critical work is going on for creating the Unified Power System of Afghanistan.
- Naturally, the question arises as to which mode it should operate with neighboring power systems in the future.
- Study conducted by Fichtner Company, showed that there is no clear decision yet, although one of the findings is clear:

220 kV lines are not enough for setting up of the Unified Power System of Afghanistan.

- From the point of CDC "Energy" view, the most attractive for CAPS from both, technical point of view and recovery/development of regional trade, is an option for development of power system in Afghanistan proposed by Fichtner, which unfortunately has not been duly appreciated:

development based on construction of 500 kV lines, which will not only be systemically important for Afghanistan itself, but at the same time will be the structural units of CAPS and will greatly enhance the existing scheme of power association.

.

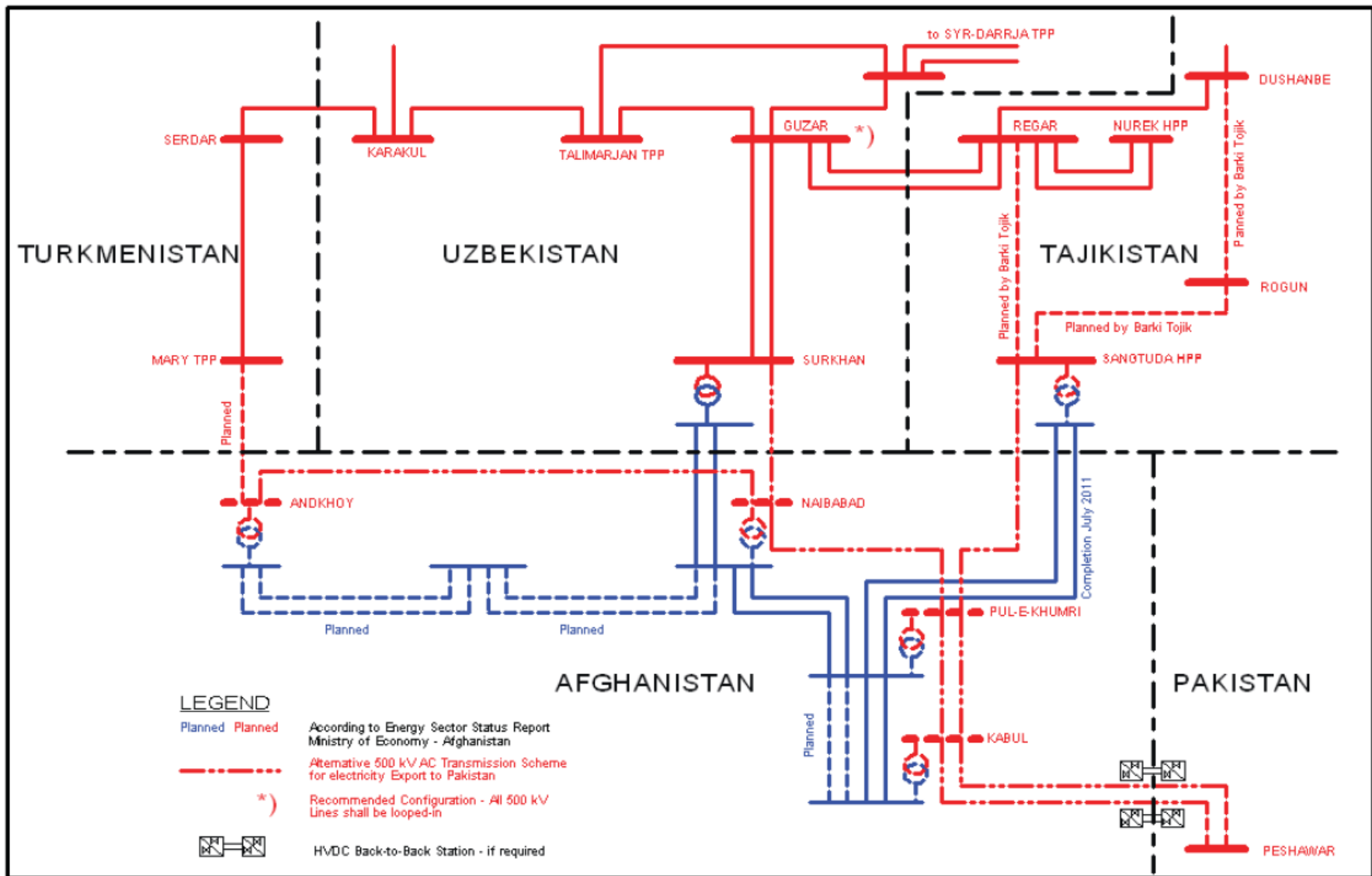


Figure 11.2.2.3-1 Alternative Transmission Scheme with 500 kV HVAC Grid for Electricity Export to Pakistan

Рисунок 11.2.2.3-1 Альтернативная схема передачи с 500 кВ ВВПТ Сеть для Экспорта Электричества в Пакистан

The emergence of powerful alternative power connections through Afghanistan will allow:

- restore one of the most powerful areas of power trade between Turkmenistan and Tajikistan, which will mitigate the problem of winter shortage in Tajikistan;
- provide the impetus for restoration of the currently disabled links between the power systems;
- reanimate also some other areas of power trade between the countries of Central Asia
- not only transmit electricity from Central Asia to South Asia (via the DC link), but at the same time use it to cover their own deficits in CAPS power systems;
- create a permanent source of revenue for the Afghan power system as a transit grid.

- Afghan AC of 500 kV will be a structural element, an integral part of CAPS and will be used as a DC line not for six months, proposed by the CASA-1000 project, but all **year-round**.
- As to the latest, according to the CDC "Energy", with a view of regional power trade within the CAPS, the investments for more expensive project could be returned in a shorter time compared to the DC line project.
-
- Provided that it can be implemented step by step, and begin to pay off after the completion of each stage.
- It is not difficult to see that the Fichtner option keeps all positive features of CASA-1000 project.

- The main advantage of this project is that it gives a real basis for creation of a fullfledged grid for Afghanistan, which will strengthen the southern part of the CAPS.

.

- CDC "Energy" again draws attention to the fact that no matter what development option for the regional power system would be adopted, the status of emergency control in CAPS would require a revision of its basic principles and its reconstruction.

Thank you for your attention!