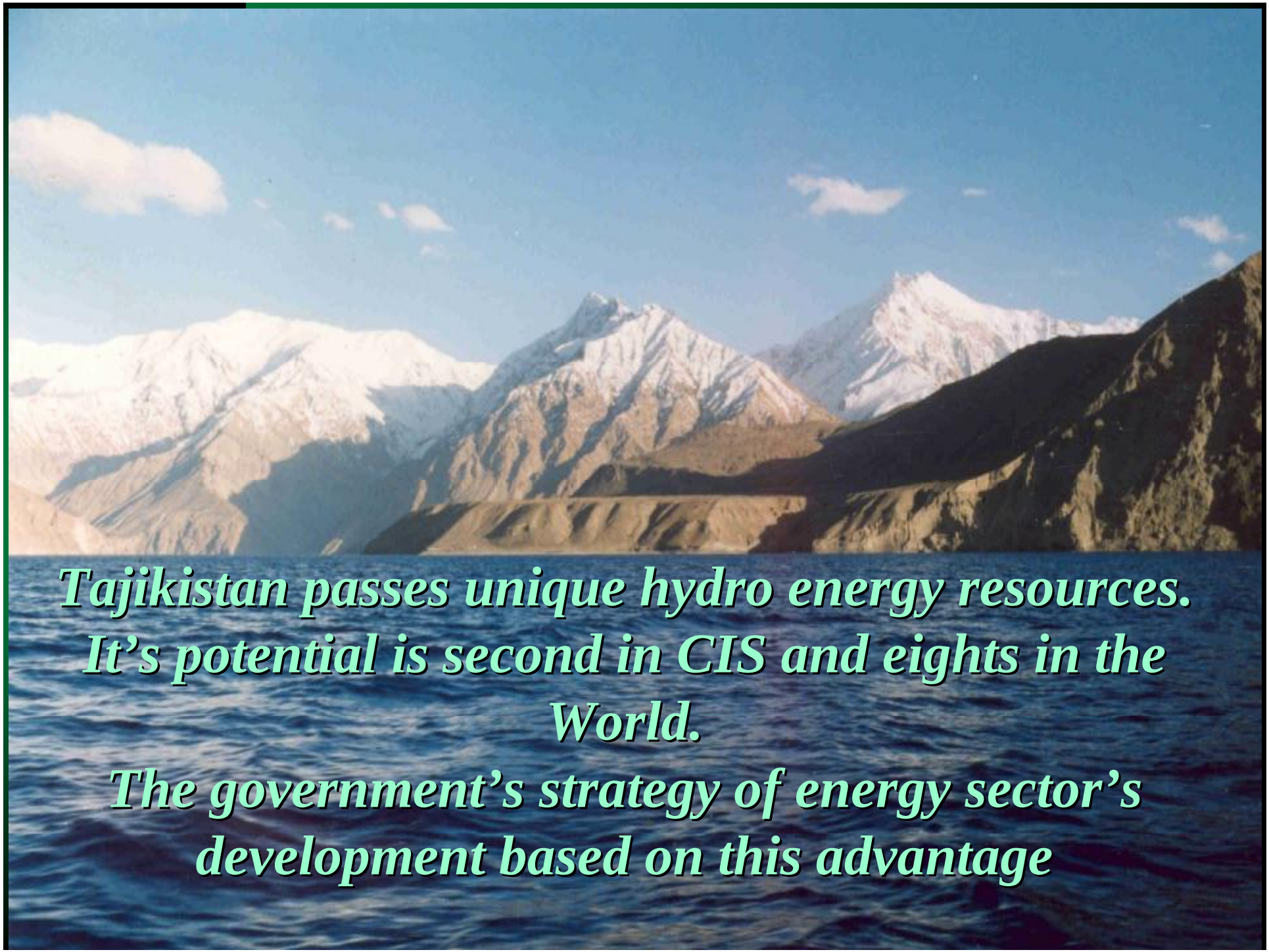
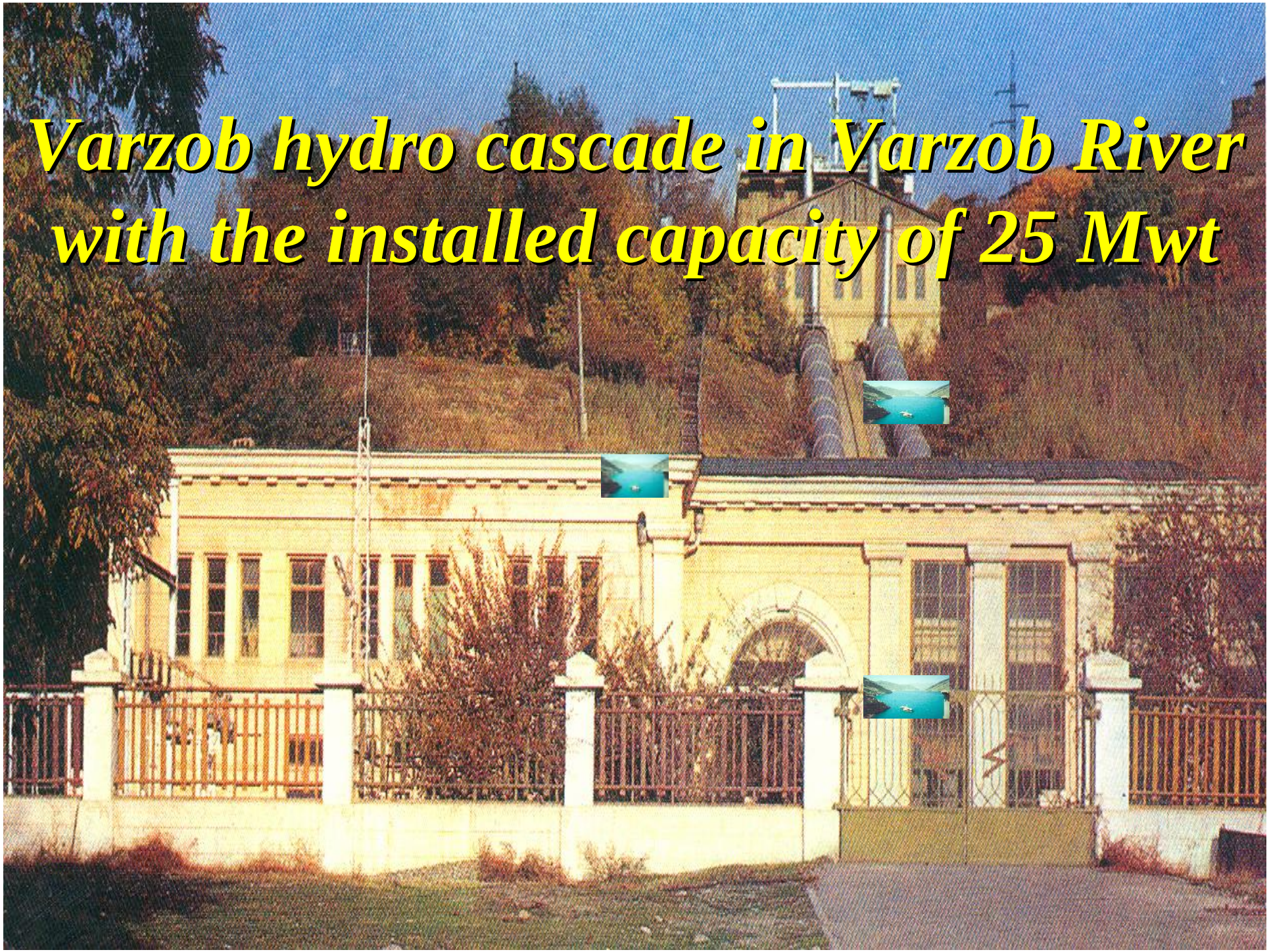
Ministry of Foreign Affairs
Republic of Tajikistan

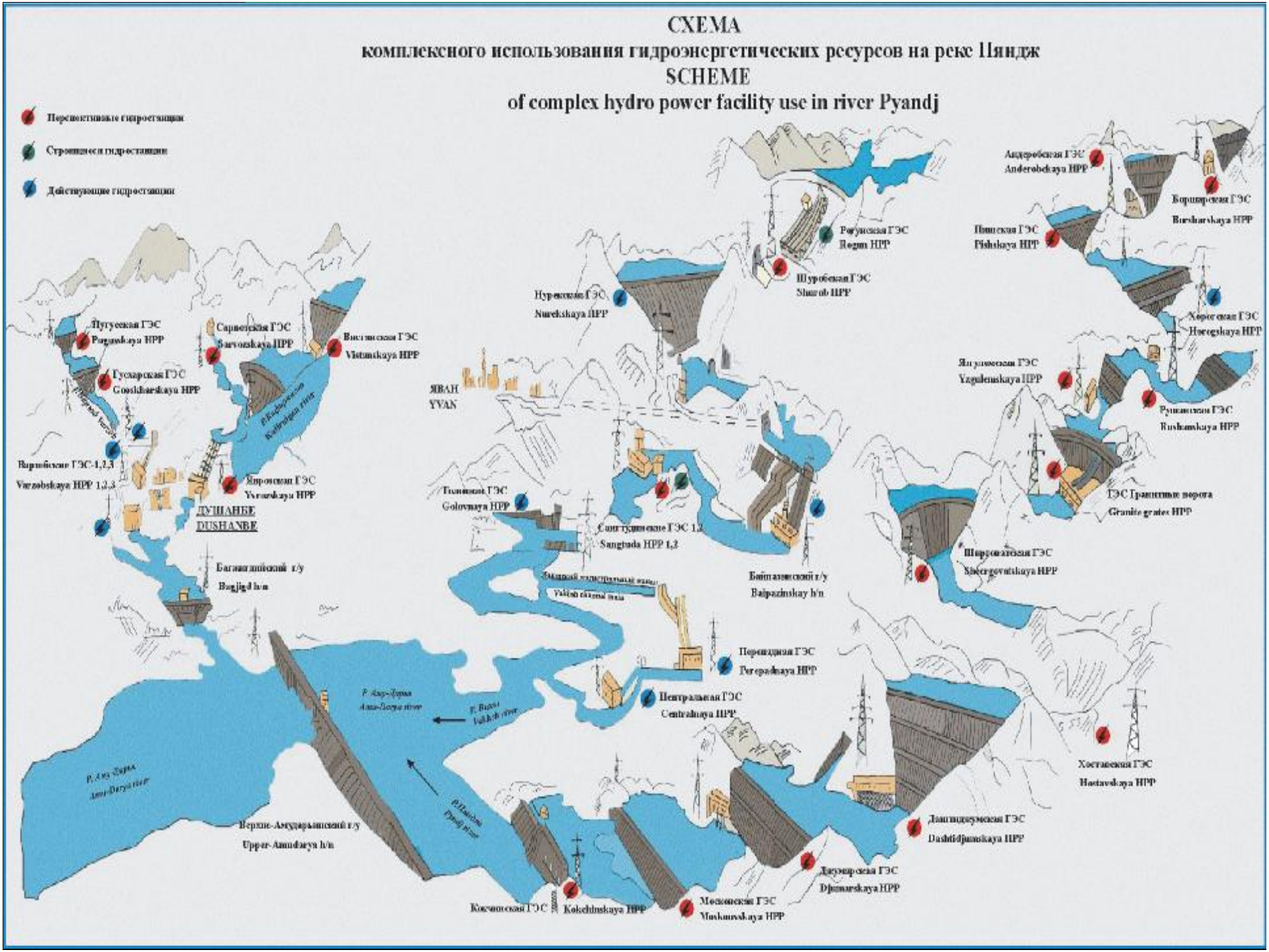
Hydro energy potential of Tajikistan; present and future

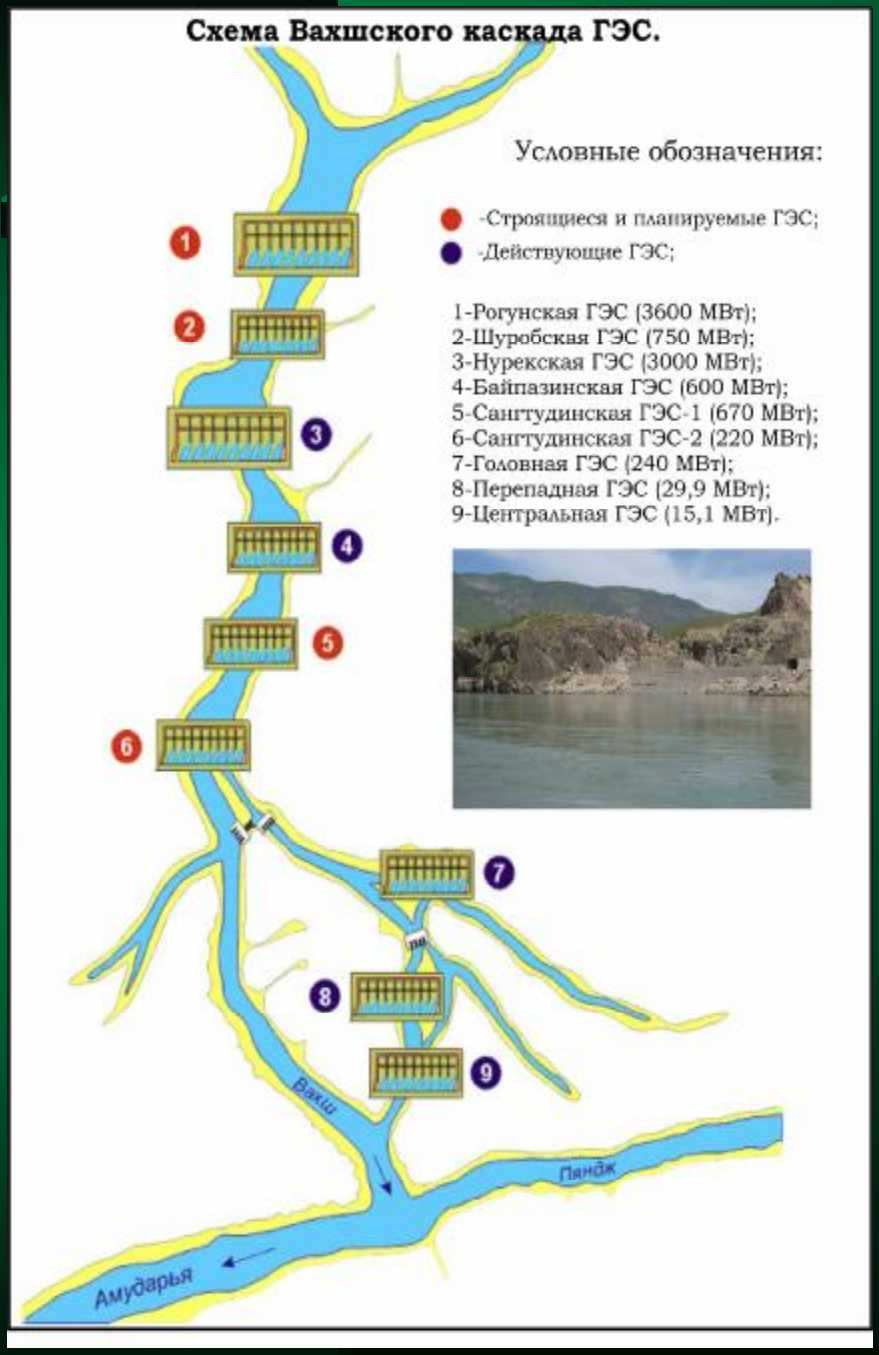

Tajikistan passes unique hydro energy resources.
It's potential is second in CIS and eights in the World.
The government's strategy of energy sector's development based on this advantage


Varzob hydro cascade in Varzob River
with the installed capacity of 25 Mwt


Among all other sectors of the economy, the energy sector has been performing sustainable growth in the past 15 years. During this period, hydro energy generation has been stabile, with the output of 17,1 billion Kwt. hour just in 2005

СХЕМА
комплексного использования гидроэнергетических ресурсов на реке Пяндж
SCHEME
of complex hydro power facility use in river Pyandj

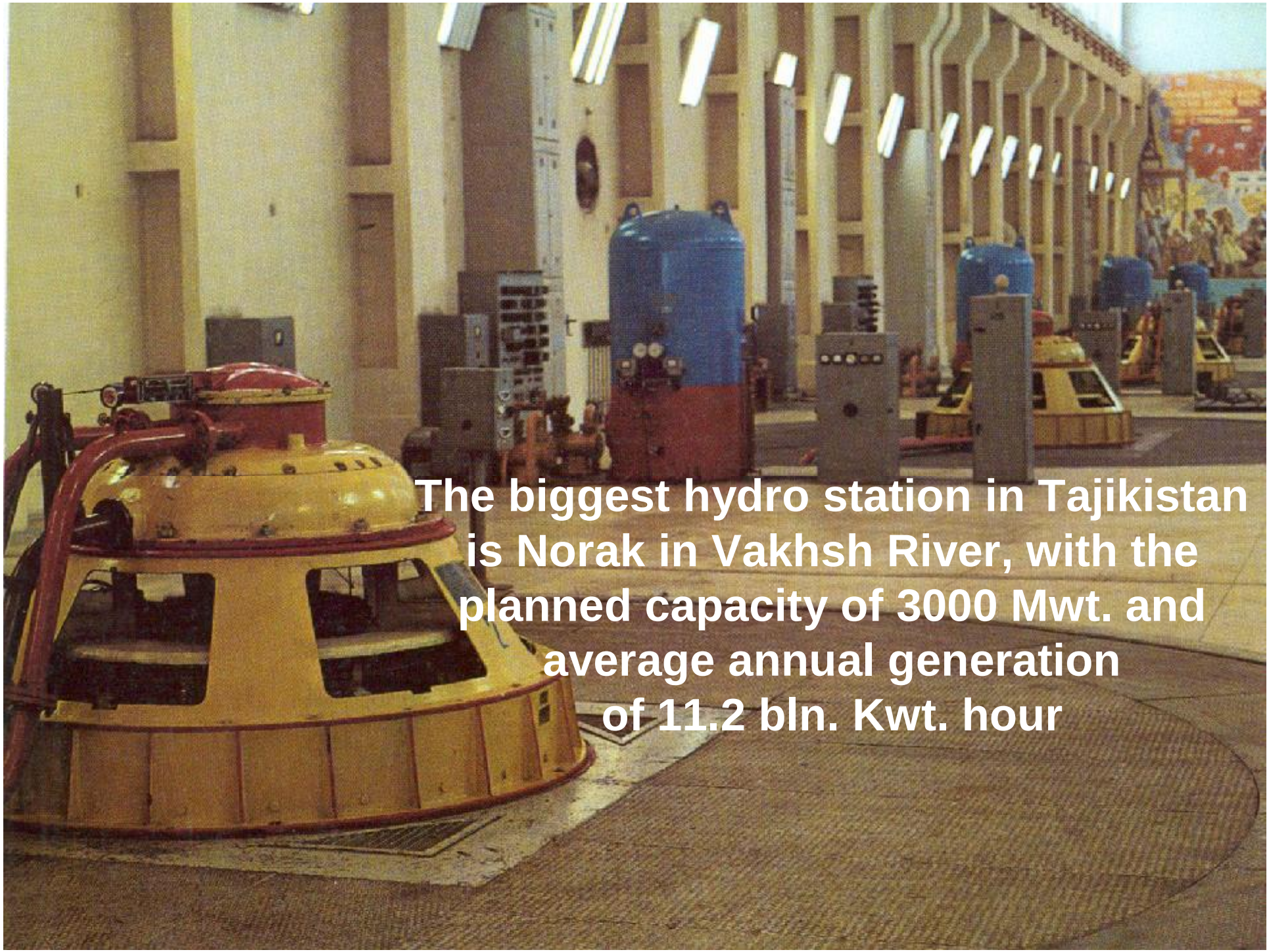




Technical and economical characteristics of installed or planned hydro stations in Vakhsh River

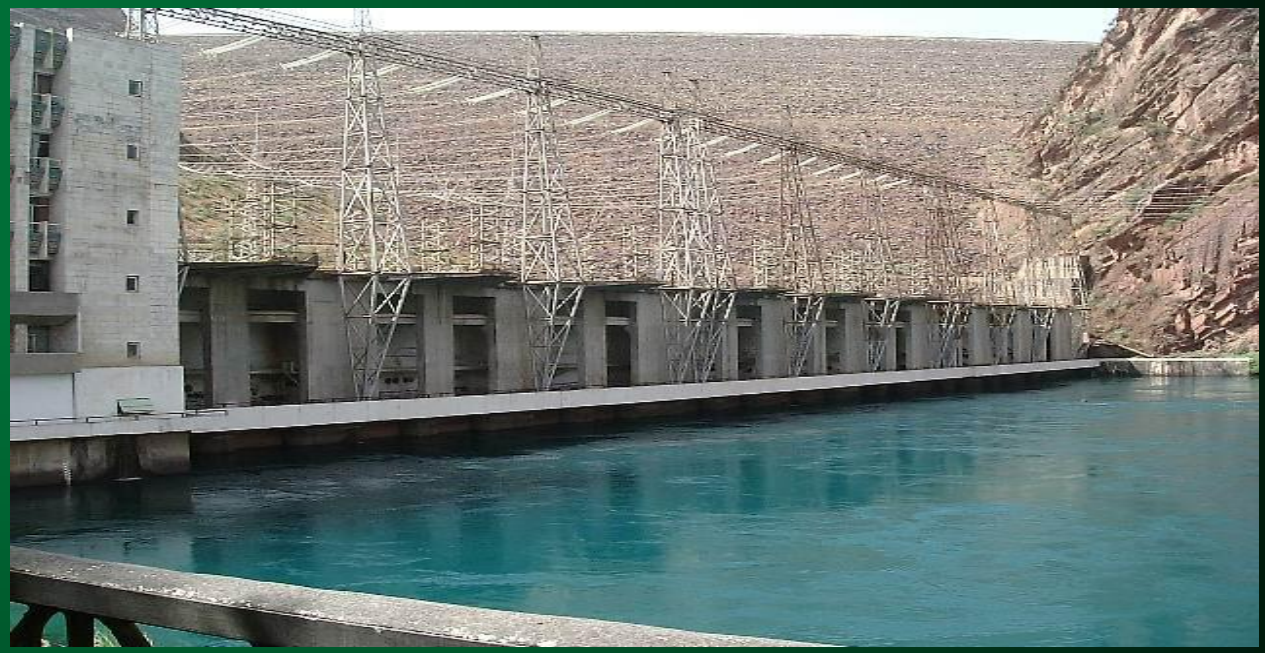
Hydro stations	*Potential capacity in thousand Kwt.*	*Energy generation, mln. Kwt. hour annual*
Rogun	3600	14000
Shurob	850	3000
Norak	3000	11200
Baypaza	600	3500
Sangtuda 1	670	2700
Sangtuda 2	220	900
Golovnaya	210	1300
Perepadnaya	29,9	220
Centralnaya	15,1	110

Current installed energy generation capacity of hydro stations is 4070 thousand Kwt.


The biggest hydro station in Tajikistan
is Norak in Vakhsh River, with the
planned capacity of 3000 Mwt. and
average annual generation
of 11.2 bln. Kwt. hour

Baypaza Hydro Station, has potential of 600 Mwt. and annual generation of 2,5 bln. Kwt. hour

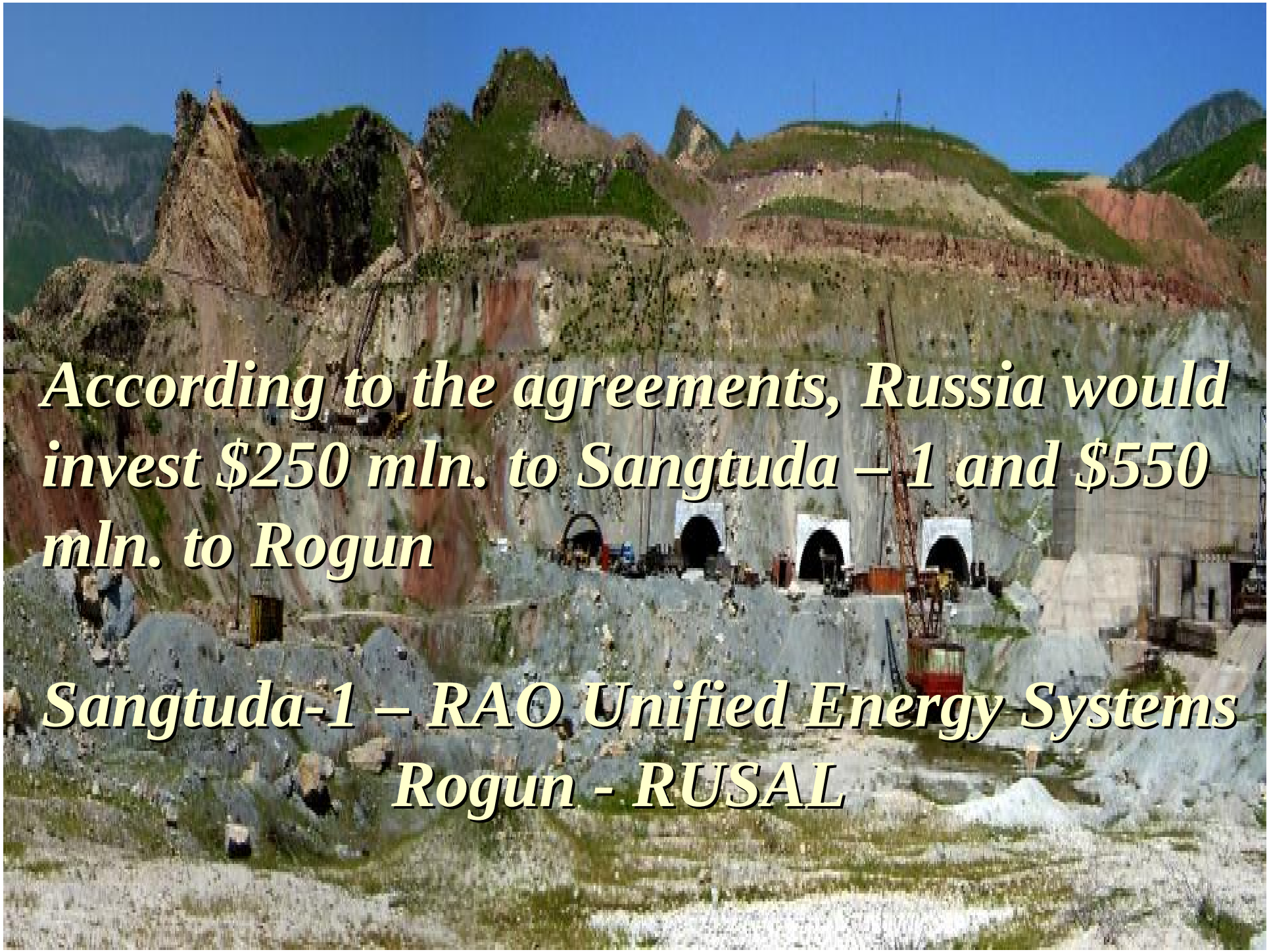
In addition to big plants, there are also 20 medium and 40 small hydro stations in remote mountain areas, with the capacity ranging from 5 Kwt. to 1500 Kwt.



The energy sector development program was adopted during the 80th, with the goal to build a number huge hydro stations and to increase production significantly.
The program set up the goal to install new capacities for 22,4 thousand Mgw., with the generation output of 86,8 bln. Kwt. hour annually, thus reaching 5 times increase of energy system

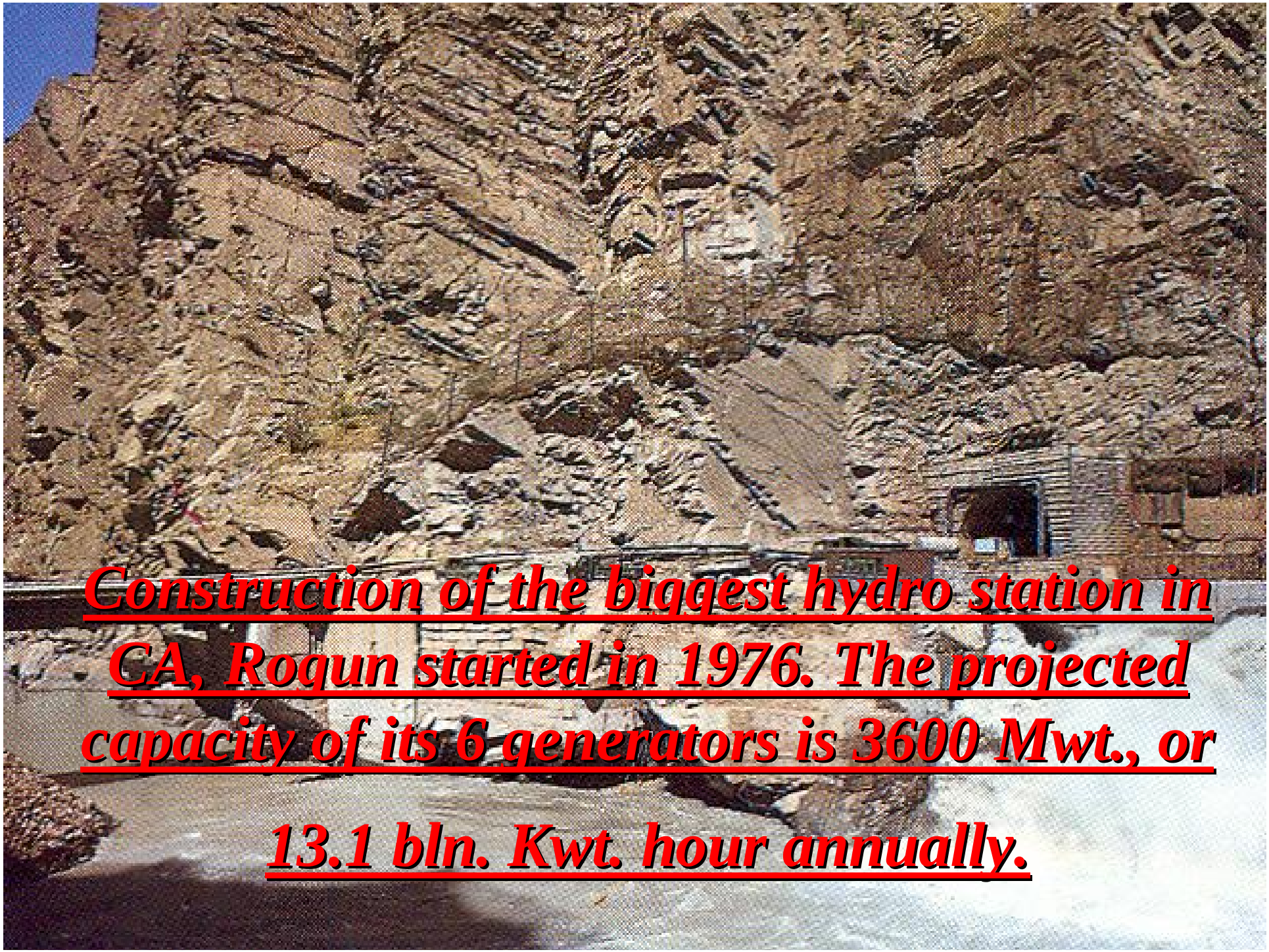
In addition to construction of new stations, there are also projects of rehabilitation and modernization of existing stations. This program will enable to increase generation capacity to 10%, which would exceed designed capacity for 350-400 Mwt.

The program also requires to complete till 2010 unfinished hydro stations left from the late 90th, such as Sangtuda -1, Sangtuda -2, Rogun, and Shurob


According to the agreements, Russia would invest $250 mln. to Sangtuda – 1 and $550 mln. to Rogun
Sangtuda-1 – RAO Unified Energy Systems
Rogun - RUSAL


Tajikistan and Iran singed a memorandum in 2005, to invest $180 mln. to completion of Sangtuda-2 station

In 2004 governments of Tajikistan and Russia signed agreements to resume the construction of two hydro stations; Sangtuda -1 and Rogun


Construction of the biggest hydro station in CA, Rogun started in 1976. The projected capacity of its 6 generators is 3600 Mwt., or 13.1 bln. Kwt. hour annually.

By 1992, the invested amount to the construction of Rogun had reached $802 mln. To complete the plant, $2,2 bln. needed

Rogun – technical characteristics

1. Dam's height м	335
2. Capacity of water basin см^3	13,3
3. Additional guaranteed water flow см^3	4,4
4. Capacity	3600 (6x600)
5. Energy generation, bln. Kwt hours	13,1

With the completion of the first stage of Rogun and Sangtuda -1, 2, and rehabilitation of existing plants, by 2010 the generation capacity of Tajikistan would reach 26,4 bln. Kwt Hour

Investment effectiveness, and performance

1. Needed investment, in mln. dollars	2198,7
2. Time of investment return, years	13,5
3. Specific of capital investment, US$.	
- for 1 Kwt of installed capacity	833
- for 1 Kwt hour 1 energy generation	0,26
- for 1 м^3 water	0,24
4. The cost price of 1 Kwt Hour of energy, US$.	0,008

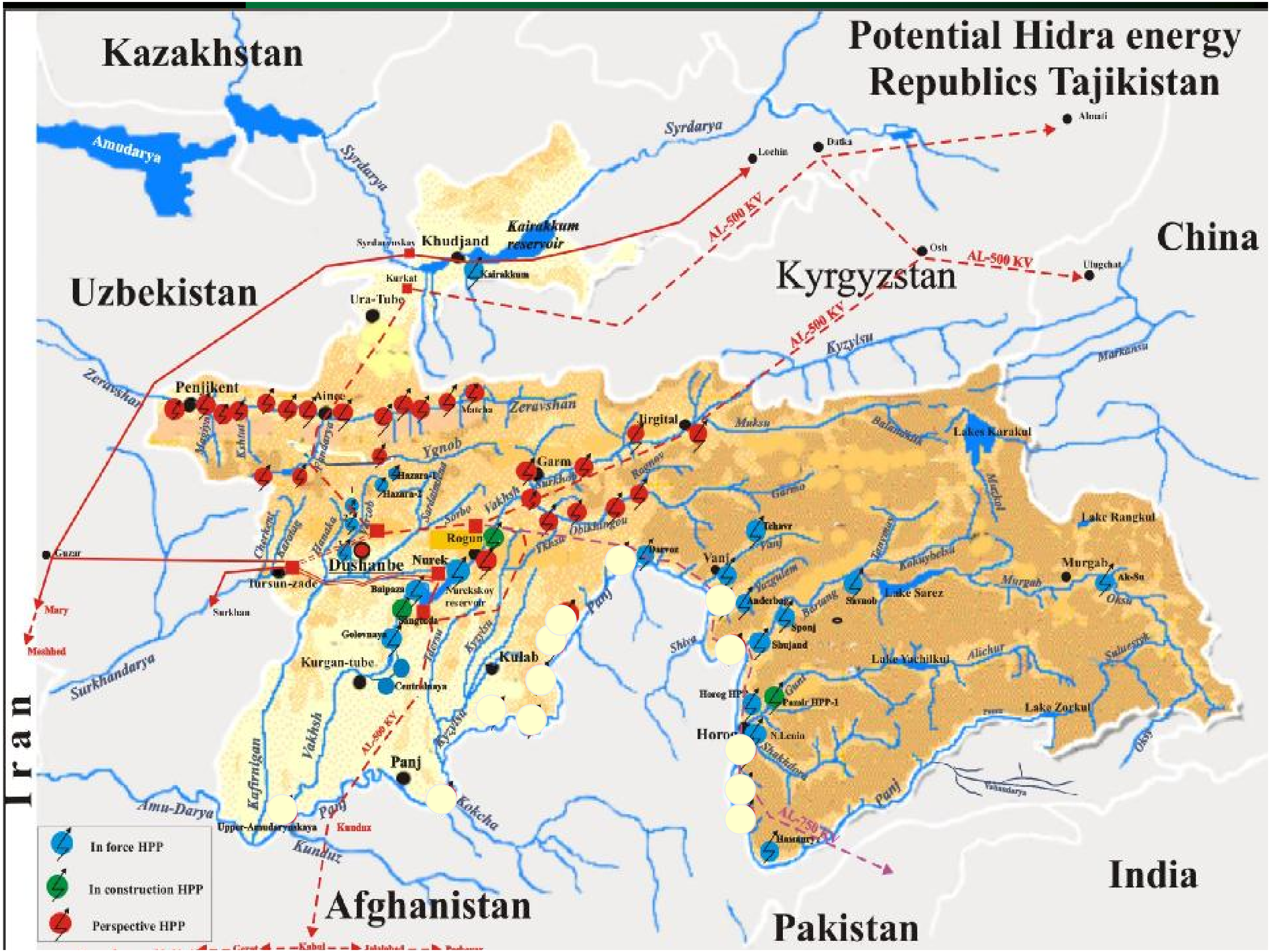
Just in Panj River, the main inflow of Amudarya, it is economically reasonable to build 14 hydro stations, ranging from 300 Mwt to 4000 Mwt, with energy generation capacity of 86,3 bln. Kwt Hour annually

Technical and economical characteristic of hydro stations on Panj River and Amudarya River

#	Station's name	Capacity, Mwt	Energy generation bln. Kwt Hour
1	Barshor	300	1,6
2	Anderob	650	3,3
3	Pish	320	1,7
4	Khorug	250	1,3
5	Rushon	3000	14,8
6	Yazgulom	850	4,2
7	Granite Gate	2100	10,5
8	Shirovat	1900	9,7

Technical and economical characteristic of hydro stations on Panj River and Amudarya River

#	Station's name	Capacity, Mwt	Energy generation bln. Kwt Hour
9	Khostav	1200	6,1
10	Dashtijum	4000	15,6
11	Jumar	2000	8,2
12	Moscow	800	3,4
13	Kokchinskaya	350	1,5
Amudarya River			
14	Upstream -Amudarya	1000	4,4



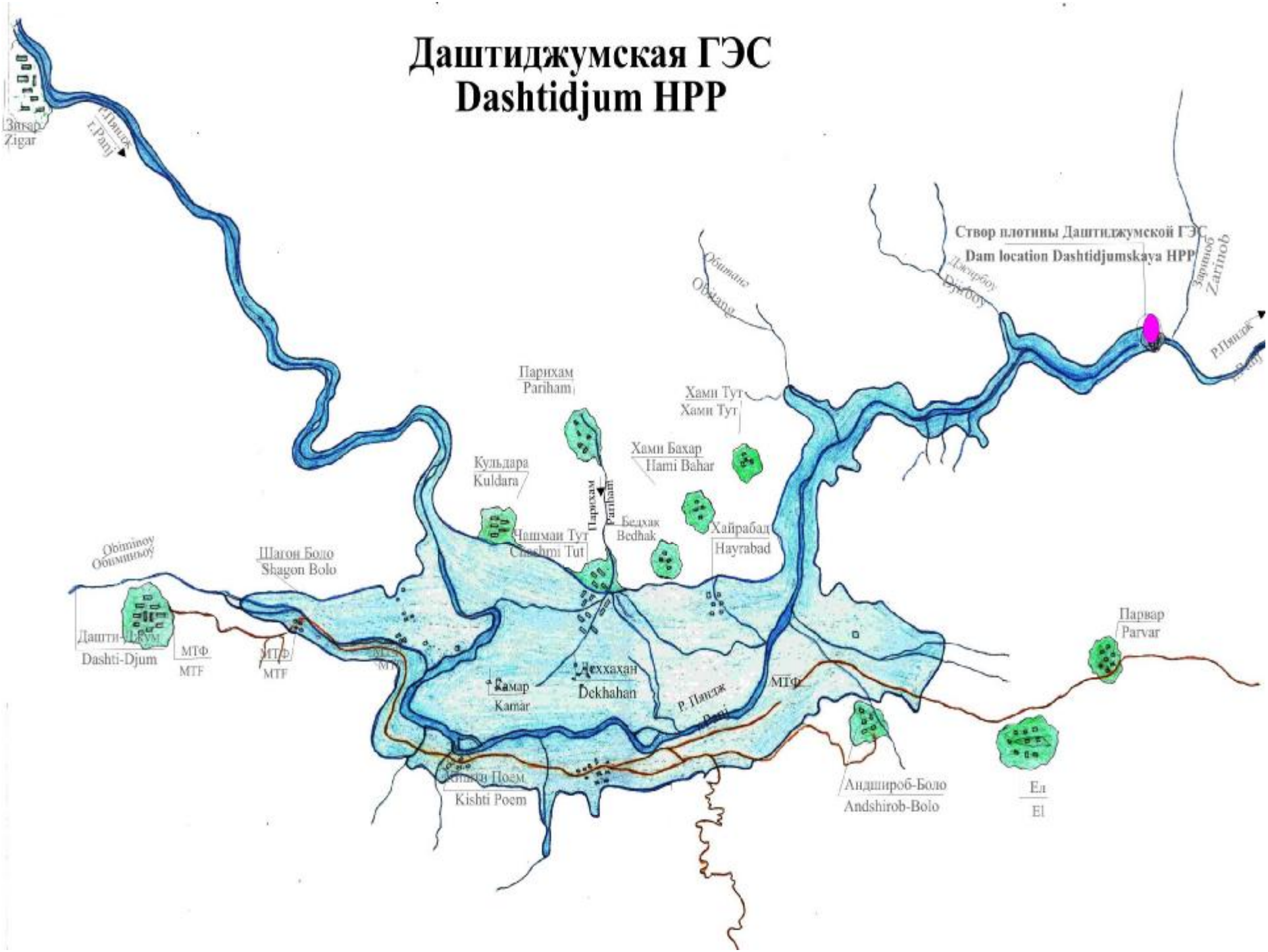
Potential Hidra energy
Republics Tajikistan
Kazakhstan
Uzbekistan
Kyrgyzstan
China
India
Pakistan
Afghanistan
Iran
Amudarya
Syrdarya
Khudjand
Kairakkum reservoir
Kairakkum
Ura-Tube
Penjikent
Zeravshan
Garm
Jirgital
Muksu
Lakes Karakul
Dushanbe
Nurek
Rogun
Nurekskoy reservoir
Baipaza
Sangtuda
Golovnaya
Centralnaya
Kurgan-tube
Kulab
Panj
Kokcha
Kunduz
Vakhsh
Kafirnigan
Amu-Darya
Upper-Amudaryinskaya
Surkhandarya
Tursun-zade
Gazar
Mary
Surkhan
Vanj
Murgab
Lake Sarez
Lake Rangkul
Lake Zorkul
Horog
Pamir HPP-1
Obikhingou
Muksu
Kyzylsu
Markansu
Ak-Su
Oksu
Shiva
Alichur
AL-500 KV
AL-750 KV
Osh
Ulugchat
Datka
Lochin
Almati
In force HPP
In construction HPP
Perspective HPP

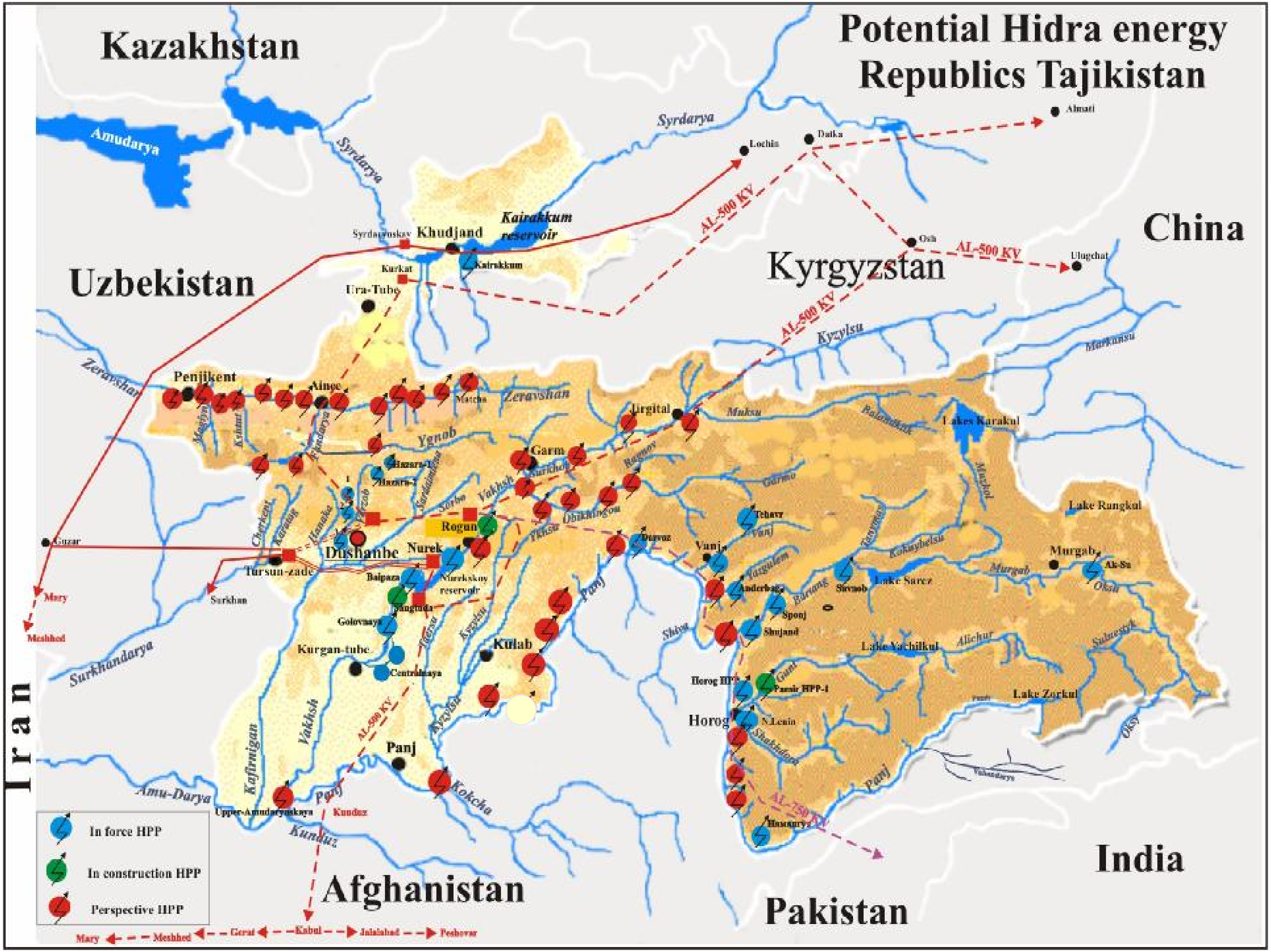
Among others, Dashtijum hydro station is the most attractive with the capacity of 4000 Mwt, and 17,6 км^3 water basin.

Technical characteristic of Dashtijum station

Cost of the project, bln. $		3,2
Dam's height, м.		320
Water basin capacity, mln.^{3}:	full	17,6
	needed	10,2
Length of water basin , км		70
Projected capacity of the station, Mwt		4000
Energy generation Kwt Hour		15,6 bln.
Cost of investment per 1 Kwt		800 $

Даштиджумская ГЭС
Dashtidjum HPP



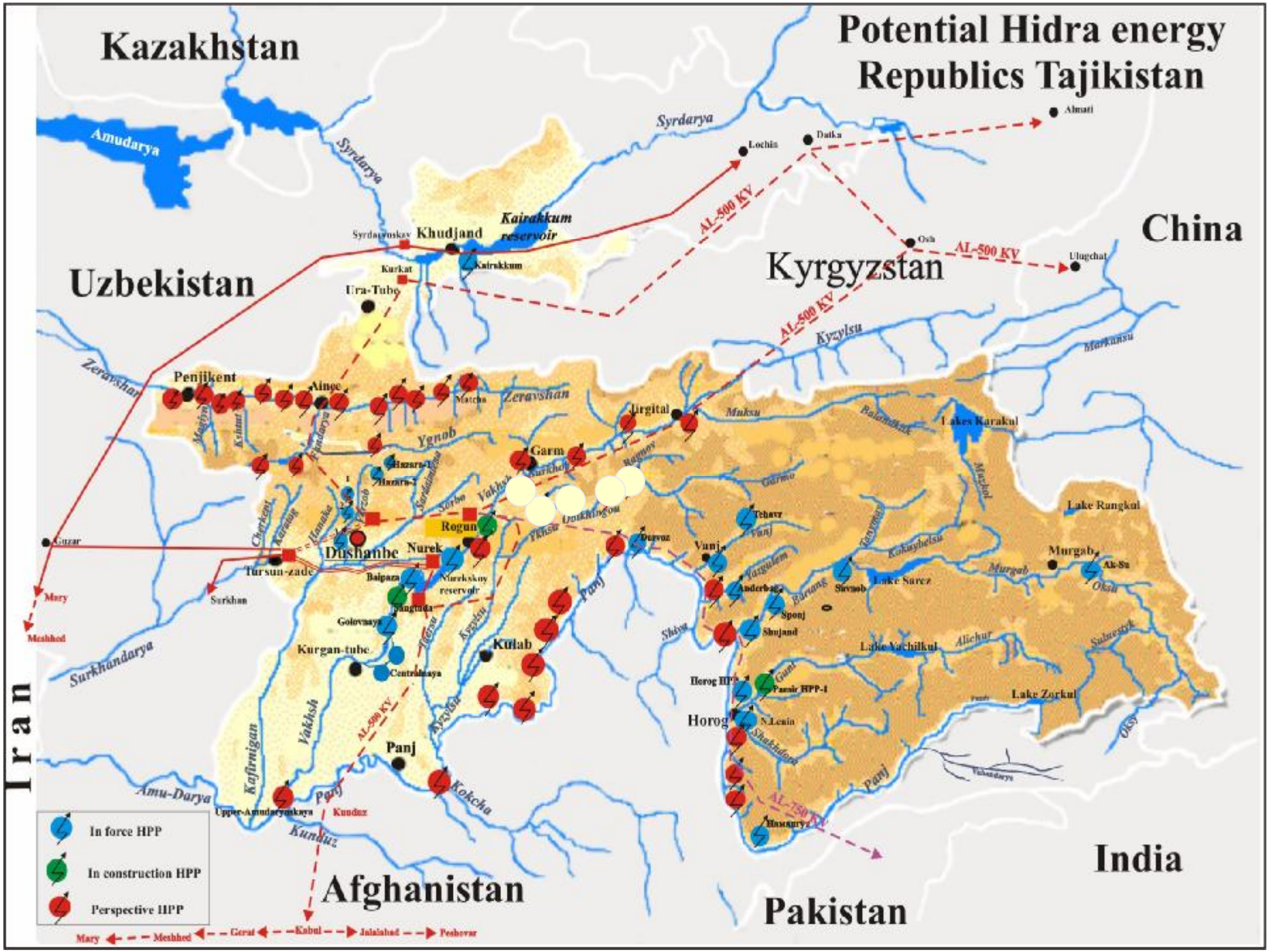

Potential Hidra energy
Republics Tajikistan
Kazakhstan
Uzbekistan
Kyrgyzstan
China
Iran
Afghanistan
Pakistan
India
Amudarya
Syrdarya
Kairakkum reservoir
Khudjand
Kairakkum
Kurkat
Ura-Tube
Lochin
Datka
Almati
Osh
Ulugchat
AL-500 KV
Kyzylsu
Markansu
Zeravshan
Penjikent
Ainee
Matcha
Jirgital
Muksu
Lakes Karakul
Ygnob
Garm
Vakhsh
Rogun
Dushanbe
Nurek
Tursun-zade
Gusar
Surkhan
Mary
Meshhed
Baipaza
Nurekskoy reservoir
Sangtuda
Golovnaya
Kurgan-tube
Centralnaya
Kulab
Panj
Kyzylsu
Kokcha
Surkhandarya
Kafirnigan
Amu-Darya
Upper-Amudaryinskaya
Kunduz
Darvoz
Vanj
Tehavr
Yazgulem
Anderbaga
Bartang
Sirvnob
Lake Sarez
Sponj
Shujand
Murgab
Ak-Su
Lake Rangkul
Lake Yachilkul
Alichur
Lake Zorkul
Gunt
Horog HPP
Pamir HPP-1
Horog
N.Lenin
Shakhdara
AL-750 KV
In force HPP
In construction HPP
Perspective HPP
Mary
Meshhed
Gerat
Kabul
Jalalabad
Peshovar

There are also other economically attractive and technically feasible hydro potentials in Tajikistan:

Obi Khingow River (5 stations, with general capacity of 712 Mwt);
Surkhob River (4 stations, with general capacity of 1077 Mwt);
Kofarnihon River (5 station, with general capacity of 411 Mwt);
Varzob River (3 stations, with general capacity 100 Mwt);
Zarafshon River (6 stations, with general capacity of 640 Mwt);
Fon Daryo River (4 stations, with genera capacity of 510 Mwt);
Mascho District's rivers (Upstream of Zarafshon, 5 stations, with general capacity 500 Mwt);
Gount River (13 station, general capacity 356,4 Mwt);
Bartang River (5 stations, with general capacity of 485,9 Mwt);

Technical and economical characteristic of hydro stations on Obi Khingow River

#	Station's name	Capacity, Mwt	Energy generation bln. Kwt Hour
1	Sangvor	800	2,0
2	Ourfatin	850	2,1
3	Shtiyen	600	1,5
4	Evtach	800	2,0
5	Gaftargouzar	650	1,67


Potential Hidra energy
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Kazakhstan
Uzbekistan
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China
Afghanistan
Pakistan
India
Iran
Amudarya
Syrdarya
Kairakkum reservoir
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Osh
Ulugchat
AL-500 KV
AL-750 KV
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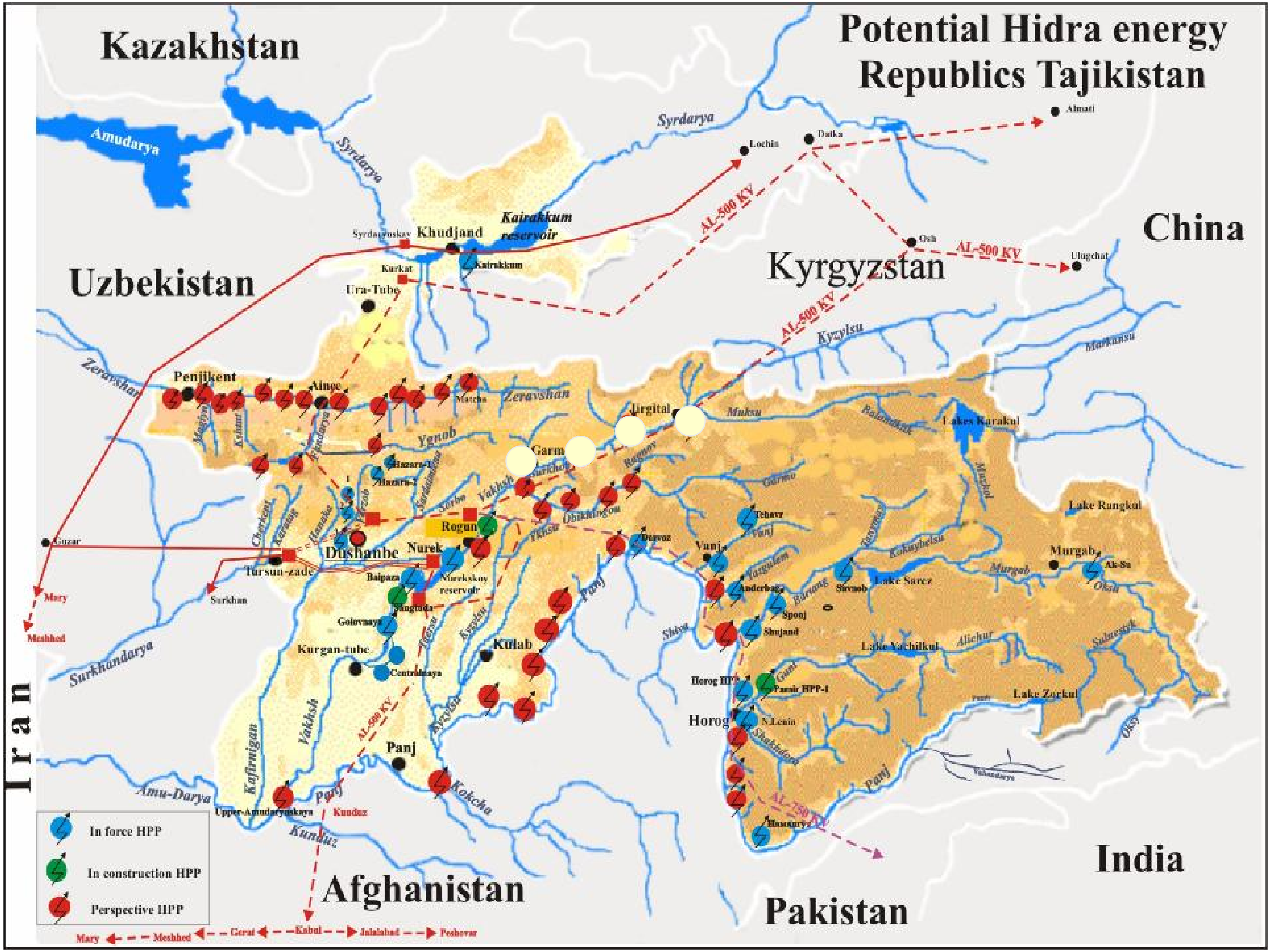
Vanj
Darvoz
Murgab
Ak-Su
Sevnob
Anderbag
Sponj
Shujand
Horog
Pamir HPP-1
S.Lenin
Shakhidora
Hamsury
In force HPP
In construction HPP
Perspective HPP

Technical and economical characteristic of hydro stations on Sourkhob River

#	Station's name	Capacity, Mwt	Energy generation bln. Kwt Hour
1	Jamboul	800	2,0
2	Sayron	850	2,1
3	Gorgen	600	1,5
4	Gharm	800	2,0


Potential Hidra energy
Republics Tajikistan
Kazakhstan
Uzbekistan
Kyrgyzstan
China
India
Pakistan
Afghanistan
Iran
Amudarya
Syrdarya
Kairakkum reservoir
Khudjand
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Ynob
Garm
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Lake Yachilkul
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Kafirnigan
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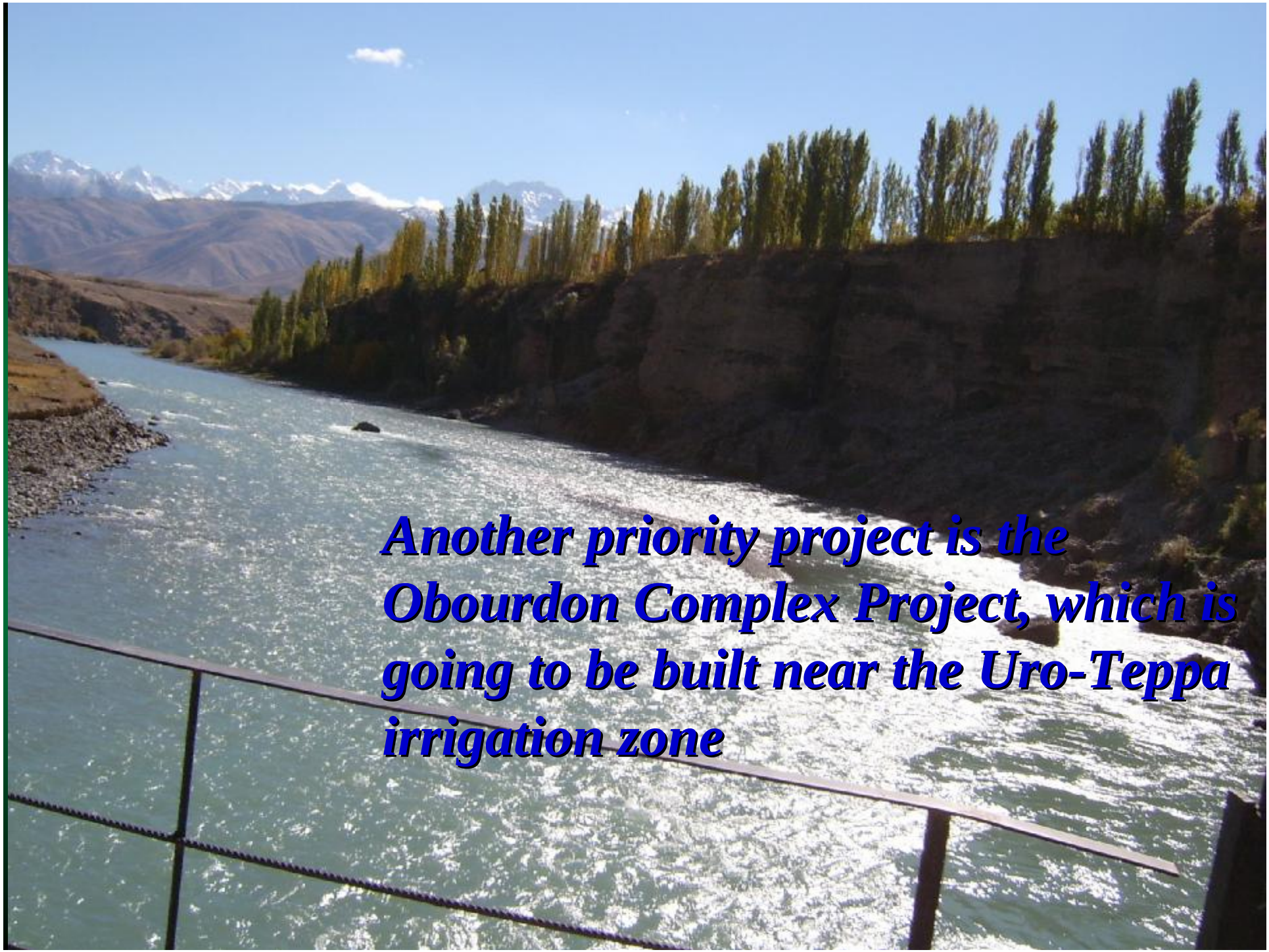
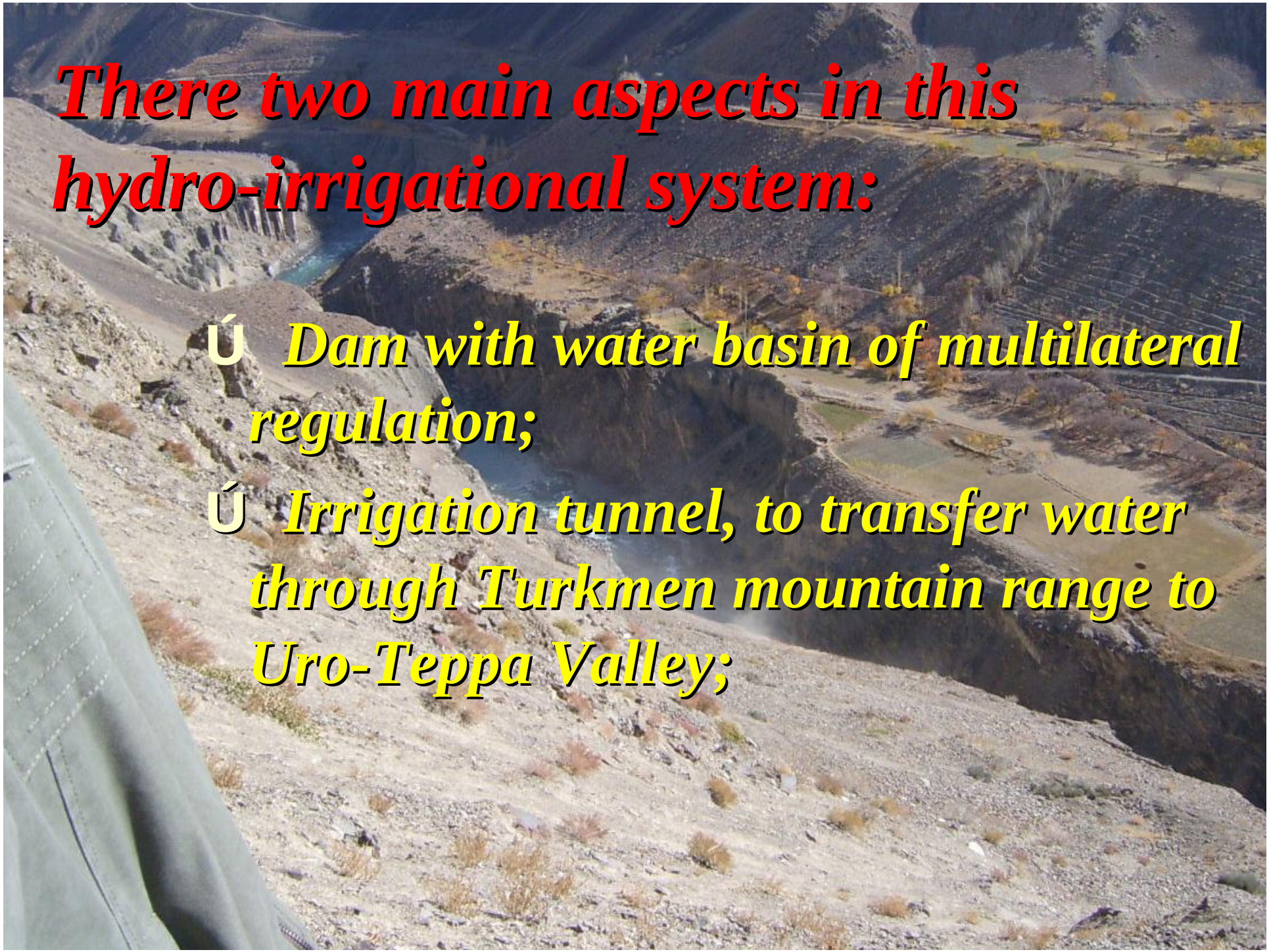
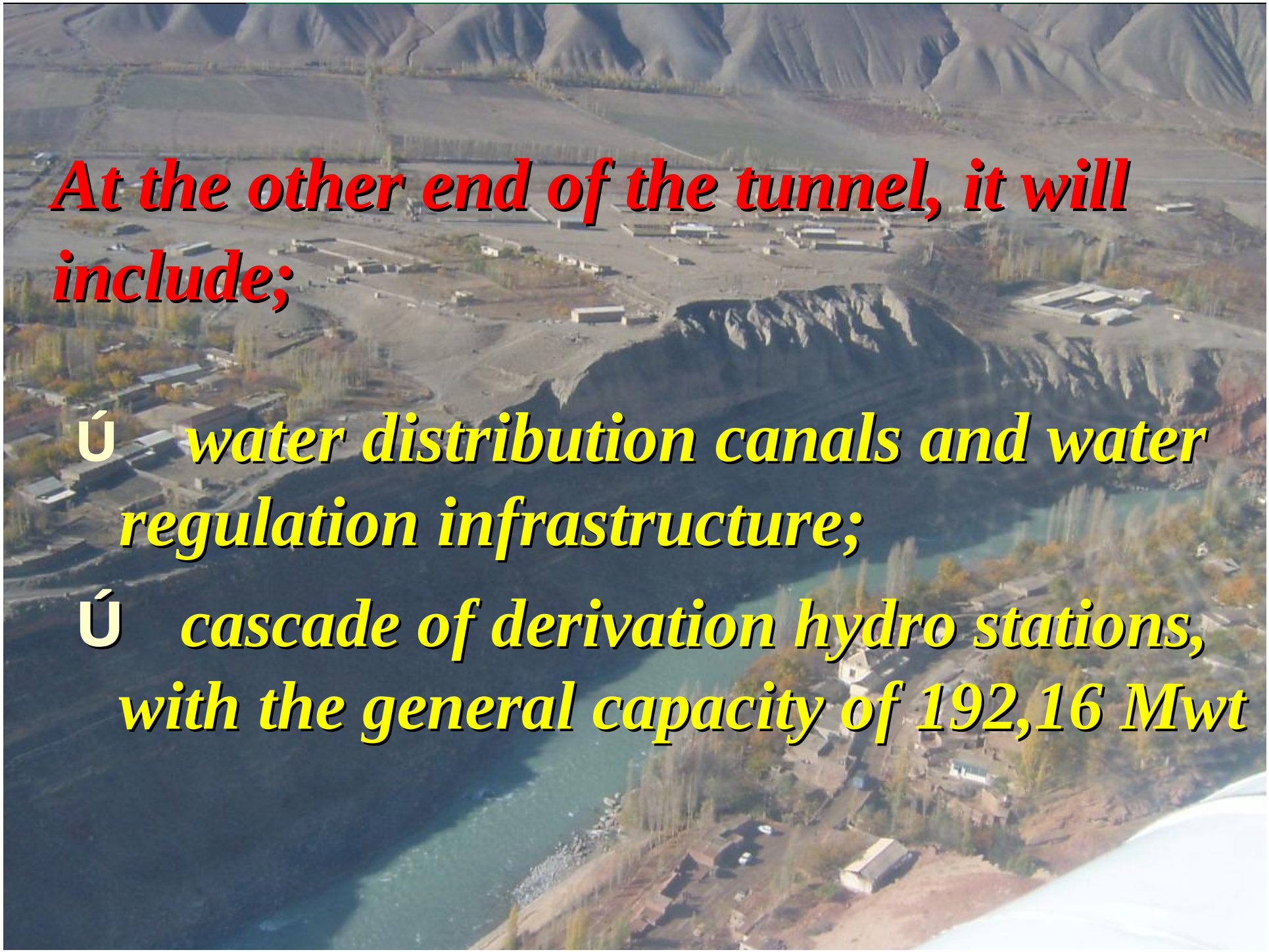

Another priority project is the Obourdon Complex Project, which is going to be built near the Uro-Teppa irrigation zone



There two main aspects in this hydro-irrigational system:

- *Dam with water basin of multilateral regulation;*
- *Irrigation tunnel, to transfer water through Turkmen mountain range to Uro-Teppa Valley;*



At the other end of the tunnel, it will include;

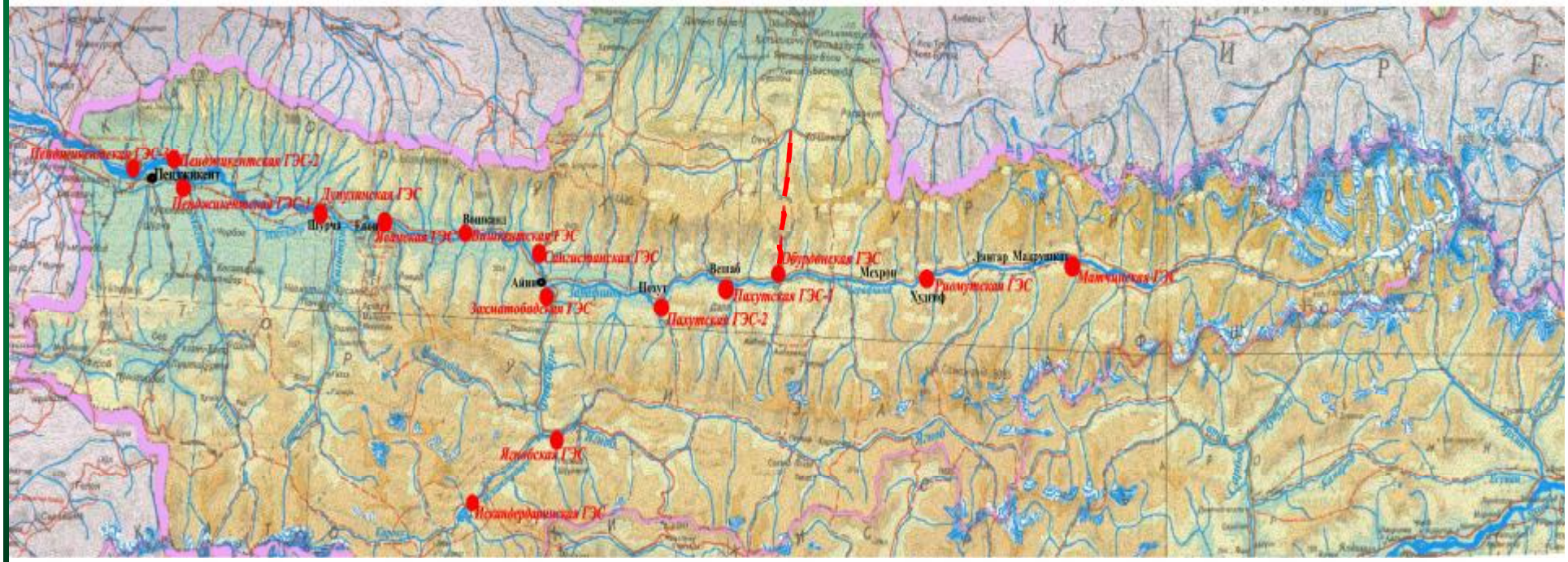
- ***water distribution canals and water regulation infrastructure;***
- ***cascade of derivation hydro stations, with the general capacity of 192,16 Mwt***

Cascade of derivation hydro stations, with the capacity 192,16 Mwt

#	Projected capacity, Mwt
1	14,57
2	13,25
3	13,28
4	13,11
5	12,64
6	12,05
7	11,79
8	11,88
9	11,85
10	8,68
11	8,71

#	Projected capacity, Mwt
12	8,70
13	6,46
14	6,46
15	5,68
16	5,68
17	5,72
18	4,54
19	4,13
20	4,35
21	4,34
22	4,29

Схема использования гидроэнергетических ресурсов р.Зеравшан
М 1:450 000



According to the National Development Strategy of Energy Sector, power generation will be:

By 2010 – 26,4 bln Kwt Hour

By 2015 – 35 bln. Kwt Hour

By 2025, as the result of intense development of hydro energy recourses of Panj River basin, energy generation may reach 80 bln. Kwt Hour per year

According to plenimary researches, energy consumption of Tajikistan's economy within the framework of possible intense development, would be as follow:

- **2010 – 21,4 bln. Kwt Hour;**
- **2015 – 24,6 bln. Kwt Hour;**
- **2020 – 28,3 bln. Kwt Hour;**
- **2025 – 32,5 bln. Kwt Hour.**

Future energy export potential

- **2010 – 5 bln. Kwt. Hour**
- **2015 – 12 bln. Kwt. Hour**
- **2020 – 30-32 bln. Kwt. Hour**
- **2025 – 47,5 bln. Kwt. Hour**

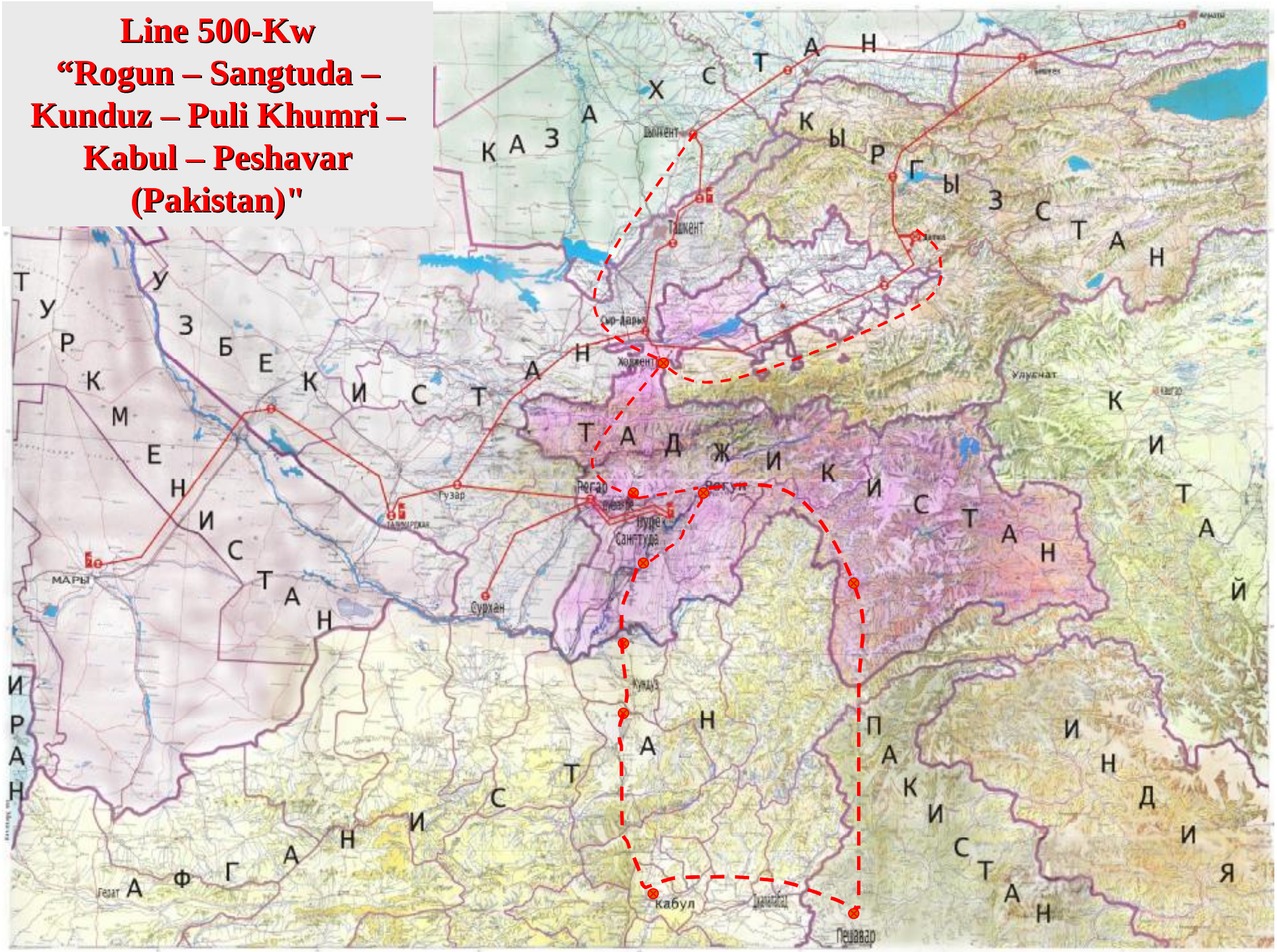

In order to facilitate energy flow in the future,
there are several transmission line projects

Transmission line 500 Kw

“Rogun– Sangtuda – Kunduz – Puli Khumri – Kabul -Peshavar"

- Length till Kabul - 585 км.
- Estimated cost till Kabul - $159.3 mln.
- Cost of the line to Afghanistan - $63,5
- Flow capacity - 8,6 bln. Kwt. hour annually
- Will serve transmission of energy from Sangtuda and Rogun stations

Line 500-Kw "Rogun – Sangtuda – Kunduz – Puli Khumri – Kabul – Peshavar (Pakistan)"

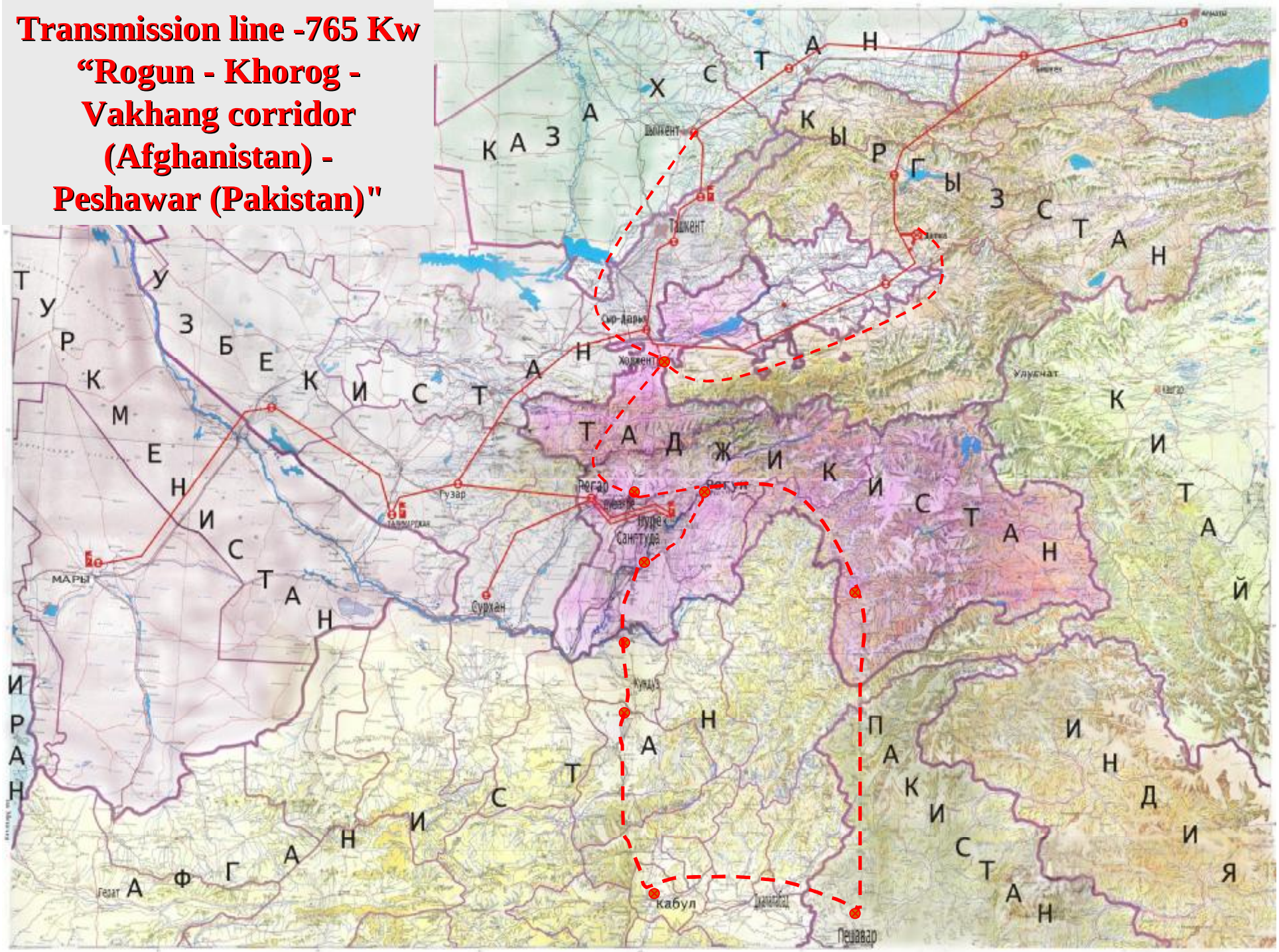


Transmission line -765 Kw “Rogun - Khorug – Vakhang corridor (Afghanistan) - Peshavar"

- Length 650 км (till Afghanistan)
- Estimated cost $274,3 mln.
- In order to transmit energy from Sangtuda and Rogun
- Flow capacity – 8,6 bln. Kwt hour annualy

This line will allow to transmit around 1000 Mwt or 15-20 mln. Kwt of power per day

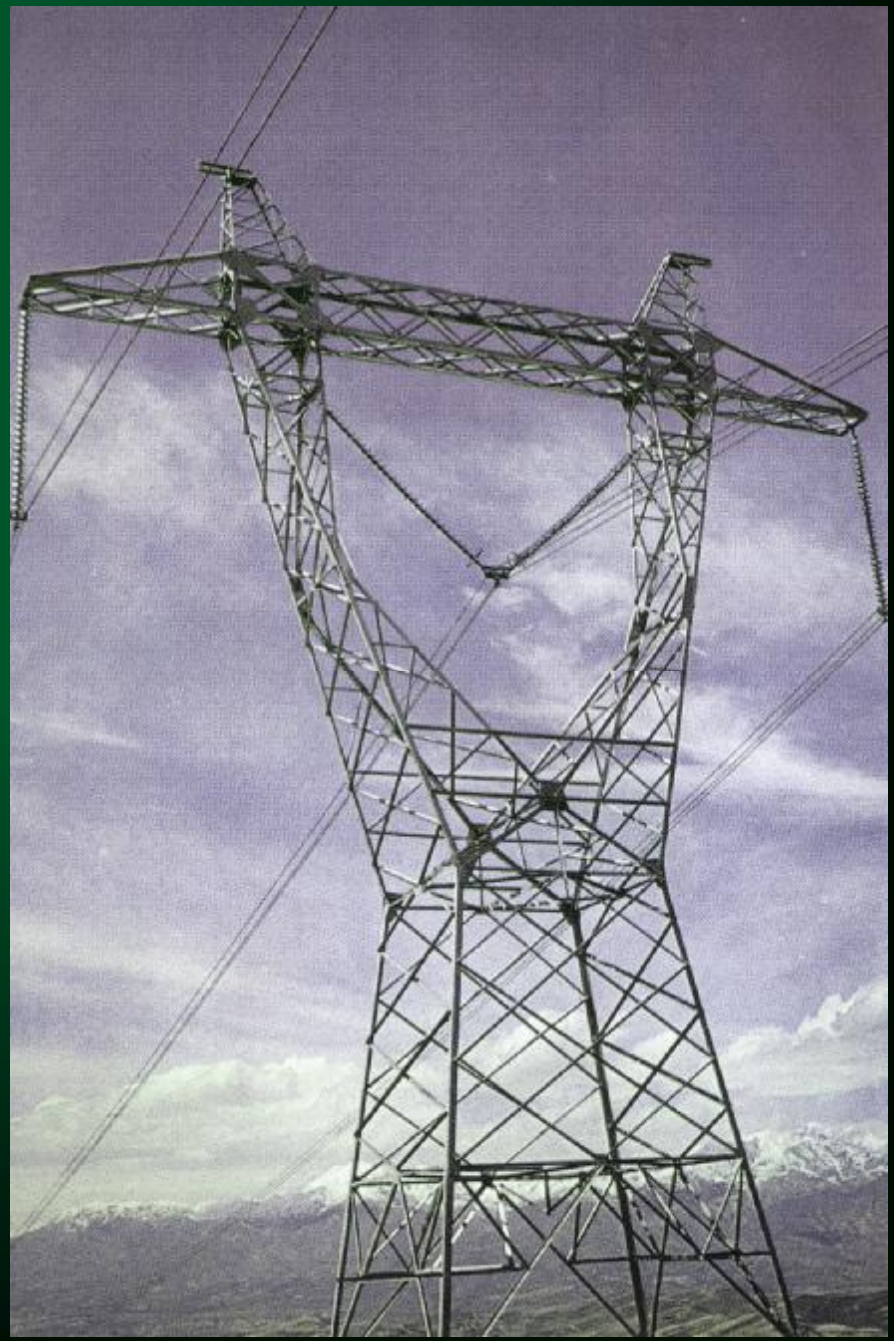
Transmission line -765 Kw "Rogun - Khorog - Vakhang corridor (Afghanistan) - Peshawar (Pakistan)"



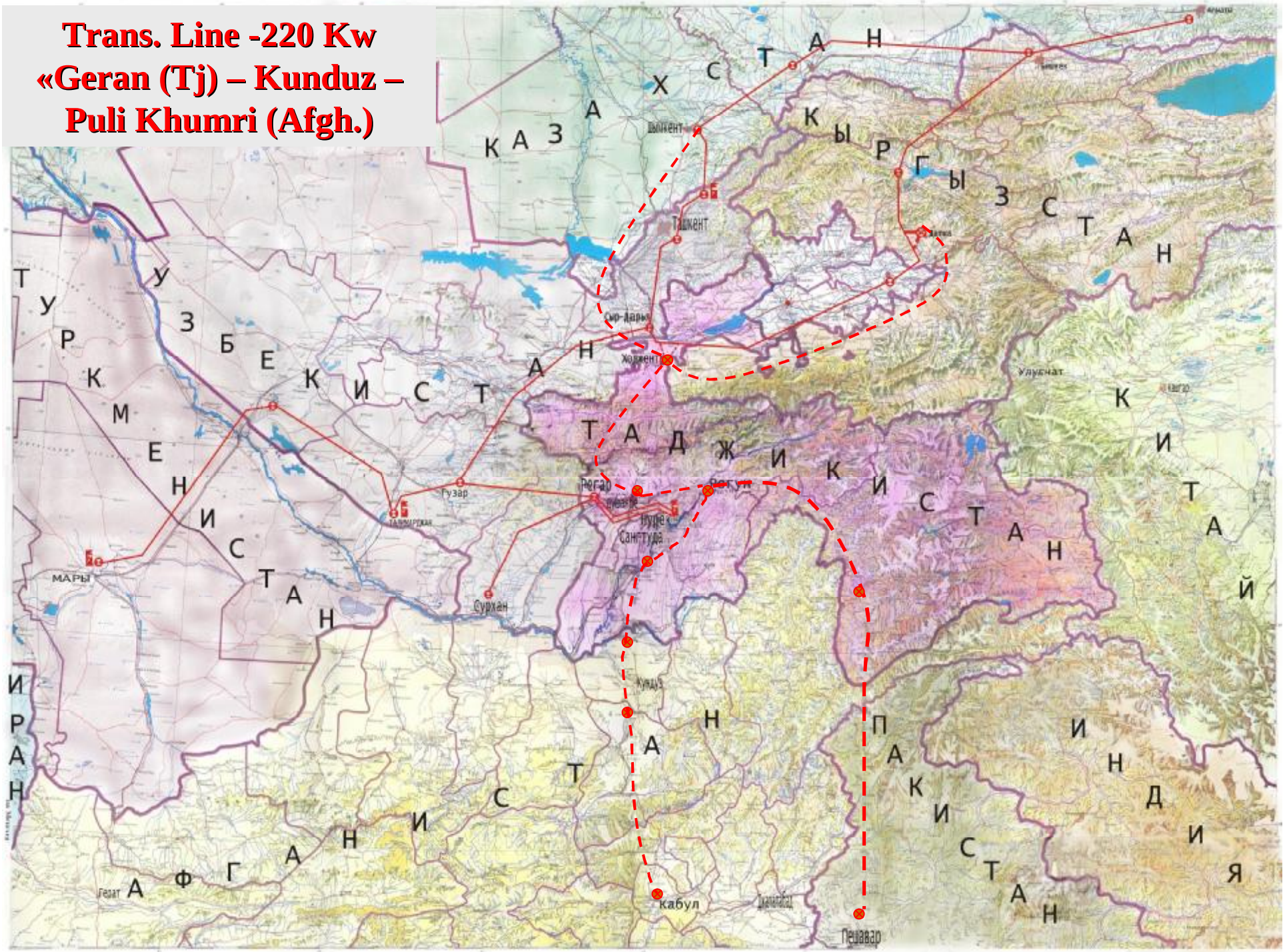
With the aim of construction of the transmission line, Ministry of energy of Tajikistan and Ministry of water and energy of Pakistan signed a memorandum of cooperation in energy fields in 2005

On April 2005 Tajikistan and Afghanistan signed the Agreement of cooperation in energy sector, which opens joint explorations of energy resources in Panj River and construction of interstate transmission lines

First stage of cooperation; the sides would start construction of transmission line-220 Kw «Geran (Tj) - Kunduz – Puli Khumri, with the capacity of 300 Mwt



Trans. Line -220 Kw «Geran (Tj) – Kunduz – Puli Khumri (Afgh.)

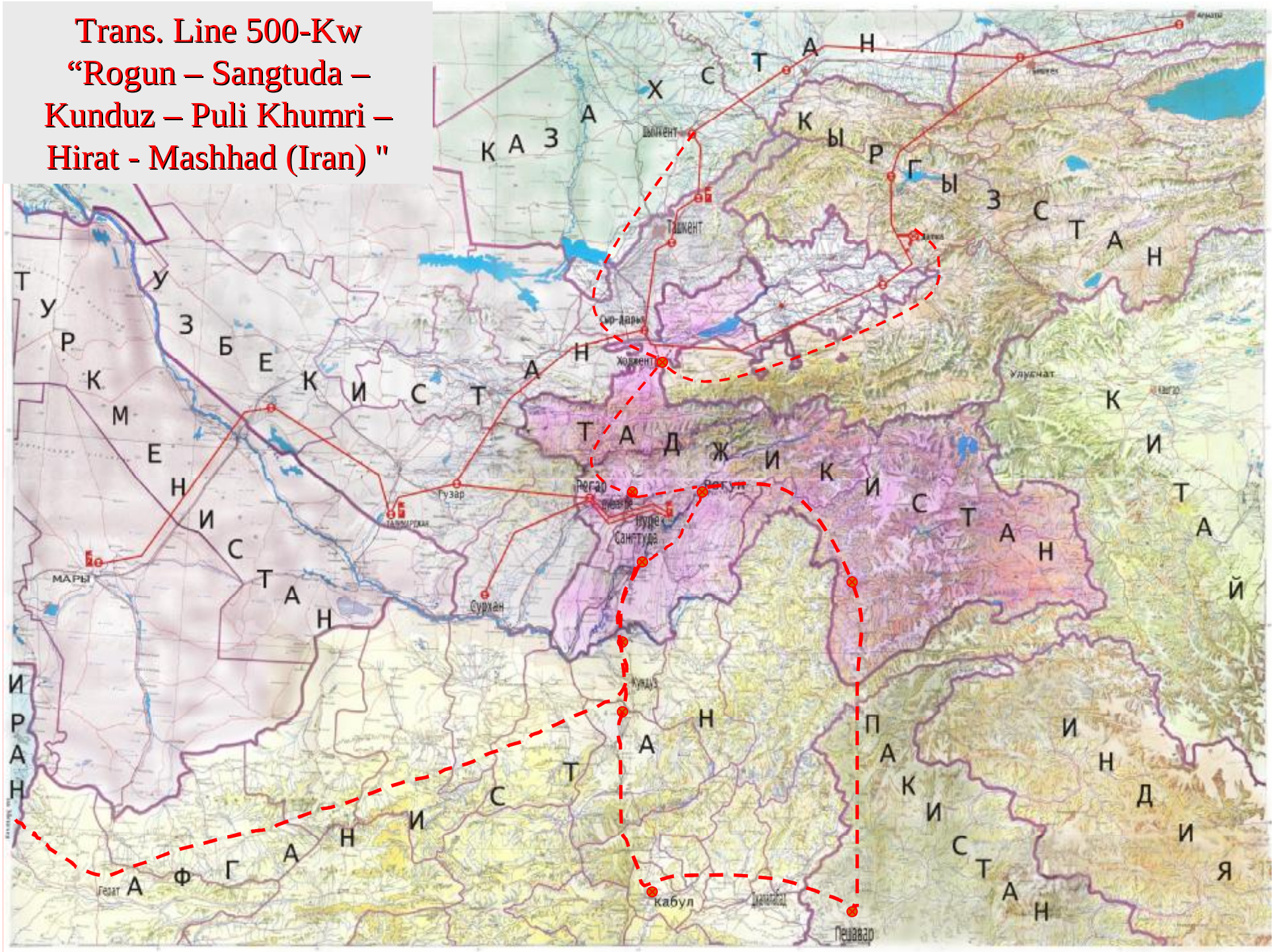


On January 18, 2006, during the official visit of the President of Tajikistan to Iran, the two sides signed an agreement on cooperation in energy field. Once again Iranian side confirmed its strong interest to invest in development of region transmission line system

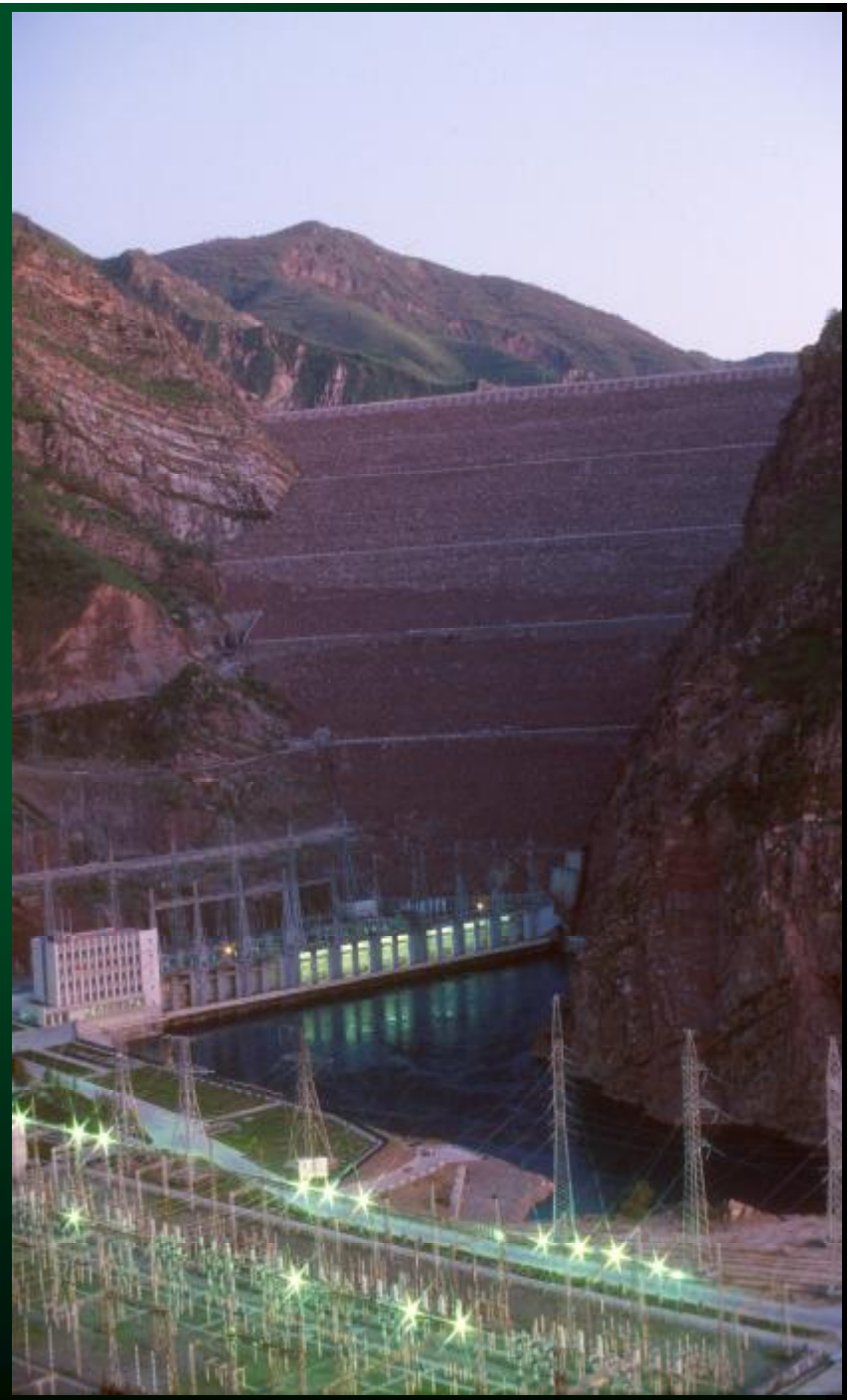
Trans. line 500-Kw "Rogun – Sangtuda - Kunduz - Puli Khumri– Hirat (Afgh.) - Mashhad (Iran) "

- Length to Mashhad 1100 км.
- Length within Tajikistan's territory 226 км.
- Cost from Rogun to the border with Afghanistan is $63,5 mln.
- Cost from Tajikistan's border to Mashhad $245,6 mln.
- Energy flow capacity – 1000 Mwt, or 15-20 mln. Kwt Hour per day

Trans. Line 500-Kw "Rogun – Sangtuda – Kunduz – Puli Khumri – Hirat - Mashhad (Iran) "



It is our main goal and priority, not also to become energy independent, but also to be able to export cheap power to booming China, rebuilt Afghanistan, developing Iran, Pakistan and India. More over, we desire to contribute with renewable and clean energy to the progress




Thank you for attention!

Tajikistan


Kazakhstan
Syrdariya River
Tashkent
100 mi
100 km
Fergana Valley
Syrdariya River
Uzbekistan
Kyrgyzstan
Khujand
Surkhab River
ALAY MTS.
China
Ayni
Fedchenko Glacier
Karakul
Gharm
Dushanbe
Tajikistan
N
Norak
Murghob
PAMIRS
Kulob
Bartang River
Qurghonteppa
Vakhsh River
Panj River
Khorugh
Pamir River
Amu Darya River
Afghanistan
Ishkoshim
TAJIKISTAN
LOW / HILLS / MOUNTAINS
Pakistan
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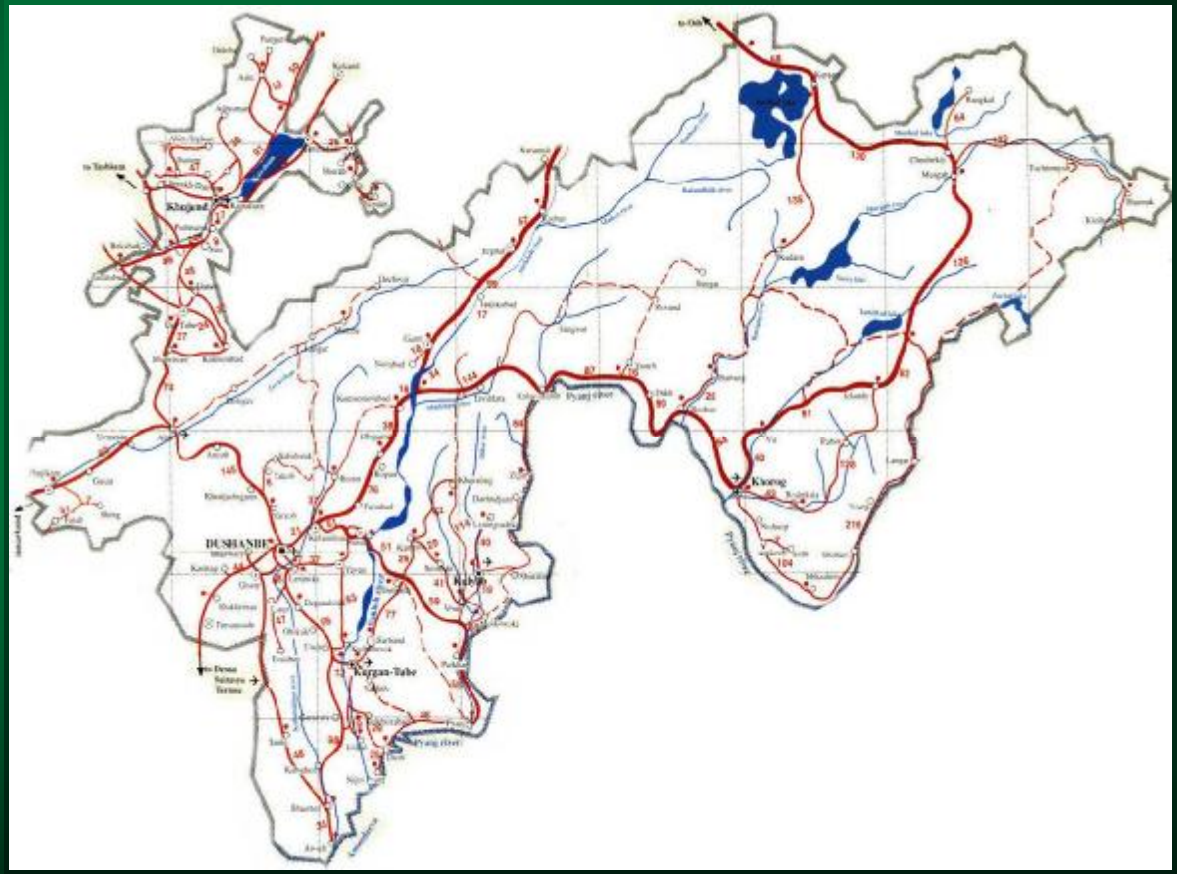
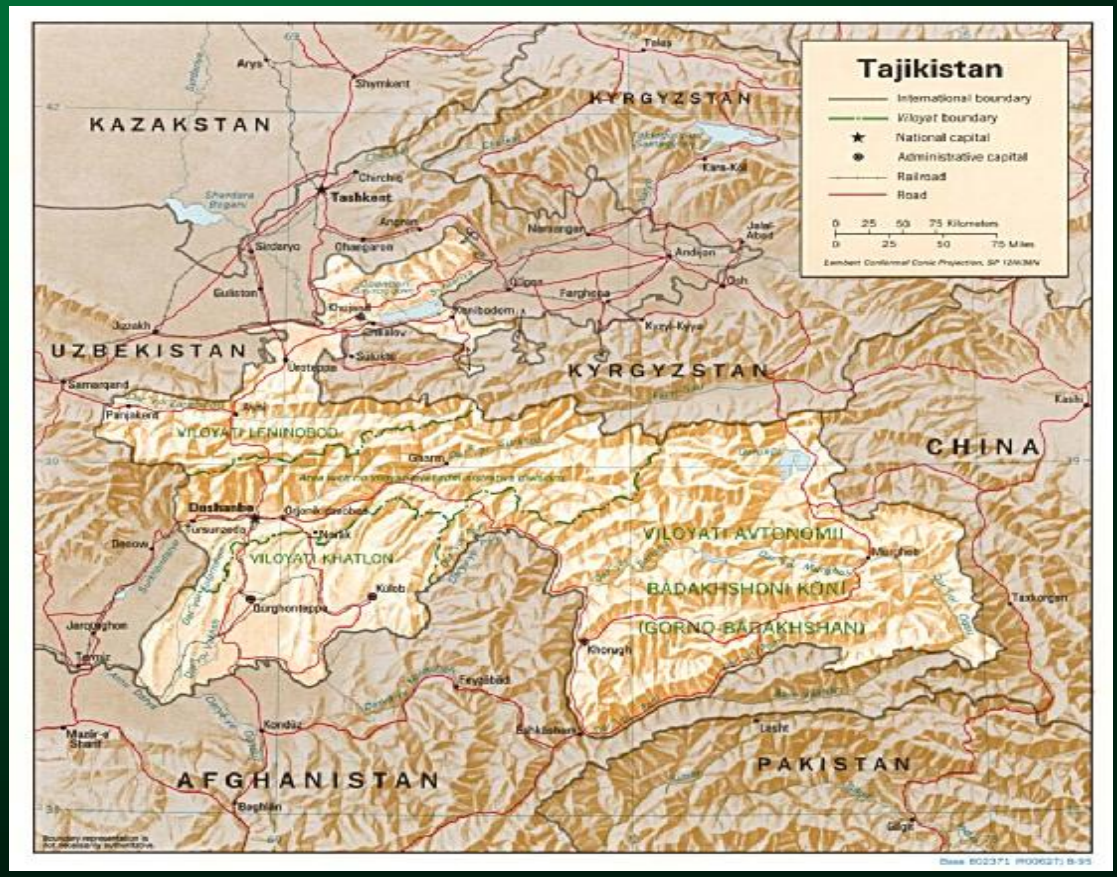
Road construction

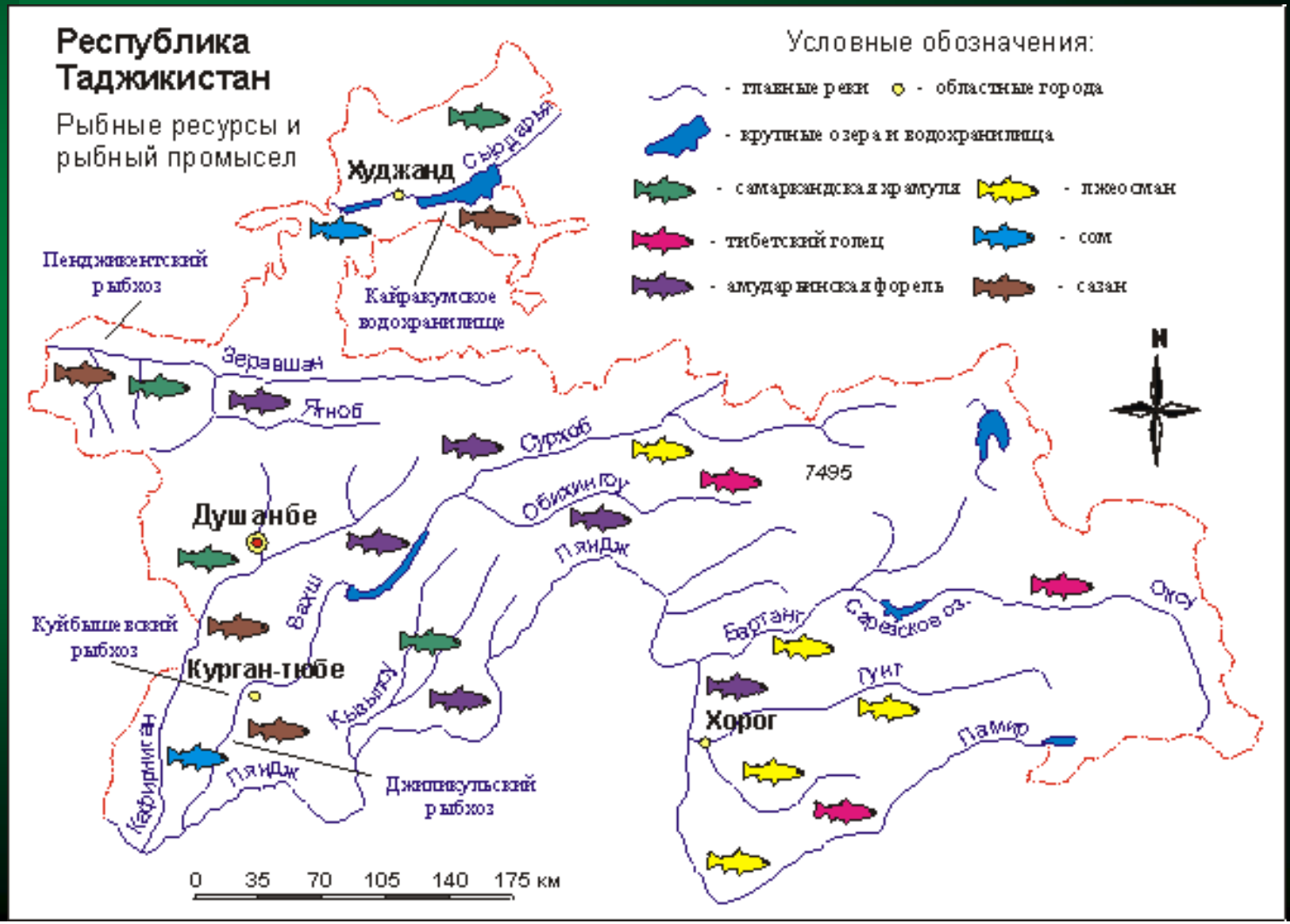


New roads

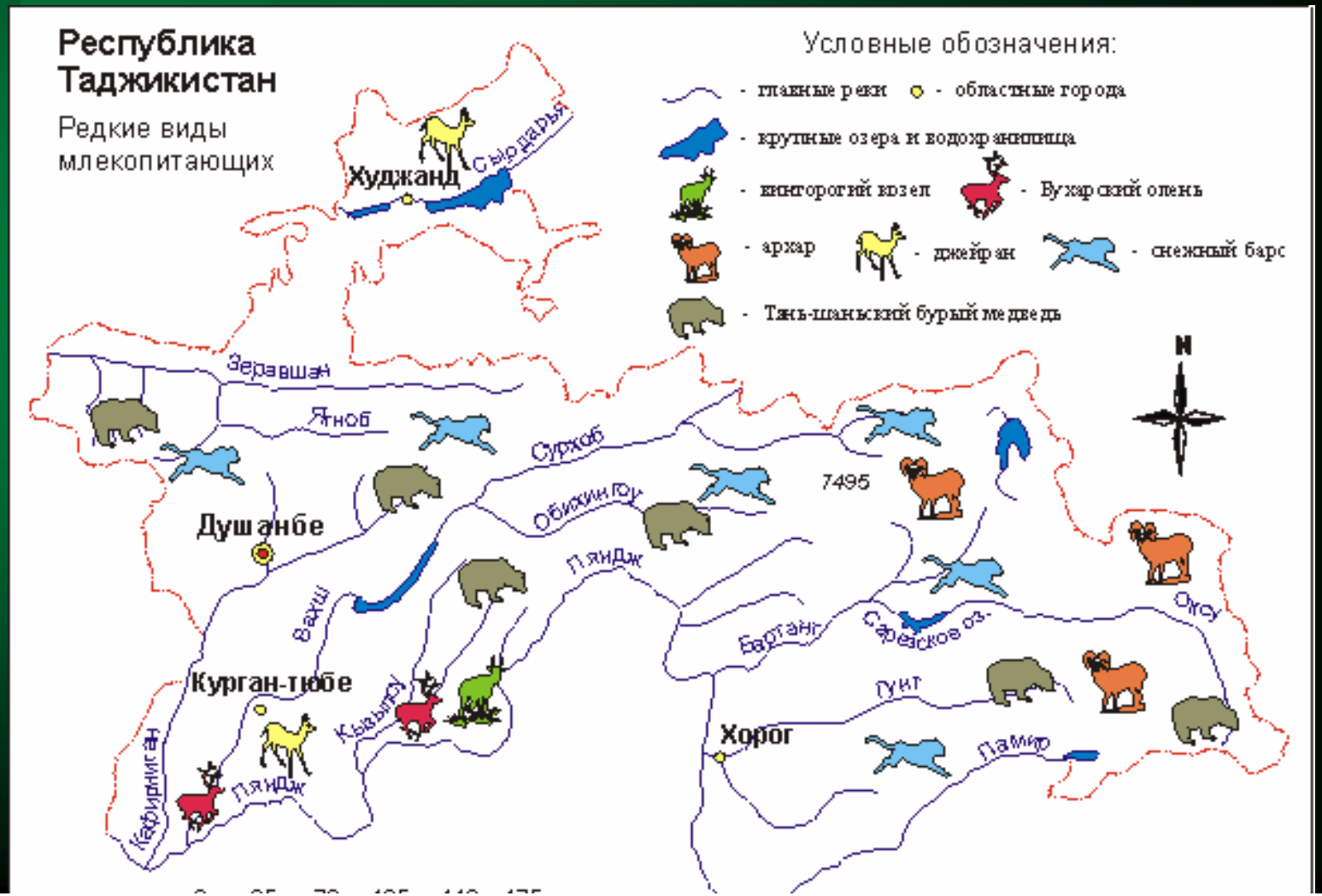
Tajikistan relief



Tajikistan fishery



Animals


Республика Таджикистан
Редкие виды млекопитающих
Условные обозначения:
- главные реки
- областные города
- крупные озера и водохранилища
- винторогий козел
- Бухарский олень
- архар
- джейран
- снежный барс
- Тянь-шаньский бурый медведь
Худжанд
Сырдарья
Зеравшан
Ягноб
Сурхоб
Обихингоу
Пяндж
Душанбе
Вахш
Кызылсу
Кафирниган
Курган-тюбе
Пяндж
7495
Барганг
Сарезское оз.
Оксу
Пшт
Памир
Хорог
N