Environmental and Social Impact Assessment for Rogun Hydro Power Plant

Environmental and Social Impacts

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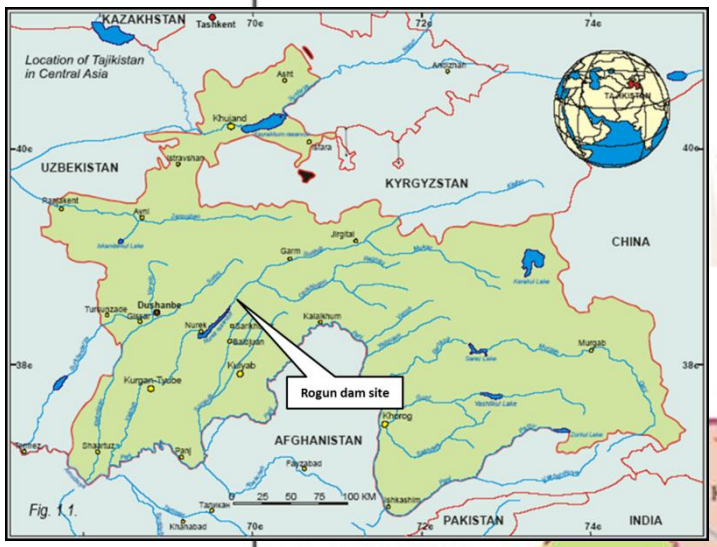
Project History

- The studies on Rogun were initiated in 1963, completed in 1978, and revised in 1981, when Nurek started operation. The main goals were water regulation for irrigation in Uzbekistan and Turkmenistan as well as power supply for Central Asia.
- The main construction started in 1982.
- In 2009, Hydroproject Institute of Moscow (HPI) was mandated to study the completion of Rogun project.
- In response to a request by the Government of Tajikistan, the World Bank is supporting ***two studies to evaluate the viability of the proposed Rogun HPP***.

Purpose and Scope

- The assessment studies aim to examine the **potential benefits and risks** of the proposed Rogun HPP and comprehensively evaluate its technical, economic, social, and environmental viability based on international standards and practices.
- **TEAS** and comparison of various project alternatives including environmental and social impact costs
  → "TEAS recommended alternative"
  (FSL 1290 alternative, 3200 MW capacity)
- **ESIA** of the recommended alternative
  → "ESIA recommended alternative"

The Project Area



The Project

Key Parameters	FSL 1290
Dam height	335 m
Reservoir active storage	10’300 hm^3
Area at FSL	170 km^2
Filling period	16 years
Operating lifetime	115 to 200 years
Installed capacity	3200 MW
Annual energy of cascade	34.3 TWh

Construction stages:

- ***Stage 1***: 3 years to 1110 m asl, start of electricity production
- ***Stage 2***: 13 years, increasing electricity generation

Associated infrastructure:

- Roads
- Transmission and distribution network

→ To be assessed by separate ESIAs

The Project Purpose

- ***Electricity production for Tajikistan***: The primary purpose is to generate electricity for Tajikistan.
- ***Electricity production for export****:* Rogun HPP would allow power sales to neighbouring countries.
- ***Flood routing****:* Rogun would provide flood routing capacity and protect Nurek and the lower cascade.
- ***Retention of sediments****:* Rogun would effectively extend the life of Nurek HPP and the Vakhsh cascade by over 100 years.
- ***Downstream flow regulation potential****:* the added storage capacity could help overcome shortages.

Potential Project Impacts

- Two areas of potentially major negative environmental and social impacts were identified:
  - **impact on local population (resettlement and social impacts)**
  - **impact on downstream river flow (water)**
- Other impacts such as those associated with large scale civil works construction are considered less significant and can be managed with known mitigation and measures if properly implemented.

Environmental Impacts: Terrestrial Flora and Fauna

- Flora and fauna in the project area (in and around reservoir area) are **strongly influenced and degraded** by human interference.
- The project area previously supported native forest.
- Habitats and biodiversity in the reservoir area are **not unique or even rare** in Tajikistan.
- Although not rare, two riparian areas in the floodplain would qualify as **“natural habitats”**.
- Additional surveys would need to be conducted to document their biodiversity value to define specific measures that would be required to offset their loss.

Environmental Impacts: Protected Areas

- The Rogun HPP would have **no significant adverse effects** on any protected area if the cascade is operated as intended.
- The **Tigrovaya Balka** State National Reserve lies on the Vakhsh river downstream of the Rogun site near Vakhsh's confluence with Pyanj river.
- Rogun could provide the **opportunity for some improvements to this protected area**. To provide support to one or more programs of maintenance and improvements of Tigrovaya Balka, a detailed plan developed and included in the project EMP is recommended.

Environmental Impacts: Aquatic biodiversity

- A total of about 85 km of the Vakhsh river would be directly affected by Rogun.
- Upstream of the Rogun dam, approximately 70 km of the free-flowing river would become a lake, with consequent **changes in biodiversity**.
- There are no important fisheries on the Vakhsh, as fish fauna is relatively impoverished and Nurek has already interrupted all long-distance fish migration. Thus, **no adverse impacts** are considered significant.
- Level oscillation is likely to limit the development of a significant lacustrine fishery in Rogun reservoir.

Resettlement and Social Impacts: "Social Area of Influence"

… comprises communities, households and individuals:

i. living within the reservoir area and to be relocated;
ii. directly affected by the construction of civil works, presence of work camps and influx of workers;
iii. acting as host communities for resettled households;
iv. maybe affected by the long–term operations of the Vakhsh cascade principally (d/s water availability);
v. maybe indirectly affected by economic development triggered by Rogun HPP;
vi. receiving the direct benefit of improved electricity supply after the project is completed.

Resettlement and Social Impacts: Local Economy

- The economic situation in the project area is **very difficult**, as it is in much of rural Tajikistan.
- Unemployment is very high, there is widespread poverty, and most families are involved with subsistence-level agriculture and animal husbandry.
- The only major has been development works related to Rogun. The primary alternative is **migrant labour** (RU).
- In the future, up to **13'000 people** may be employed during the 16 years of construction.
- Rogun will bring **social risks** due to the influx of workers, public health and safety issues.

Resettlement and Social Impacts: Resettlement

- The reservoir would cover an area of 170 km^2 where over **42'000 people live in 77 villages**. These people would have to be relocated.
- Resettlement would be carried out in two stages:
  - Stage 1: 2'000 persons (7 villages) affected by construction work and initial phase of reservoir filling
  - Stage 2: remaining 70 villages
- Resettlement began in the 1980s.
- The process is being and would continue to be implemented by a **Resettlement Unit** (since 2011).

Resettlement and Social Impacts: Resettlement

- The overall goal of the resettlement process is to **restore or improve the socioeconomic status** of affected people.
- A **Resettlement Action Plan (RAP)** for Stage 1 was prepared.
- Stage 2 resettlement will be guided by a **Resettlement Policy Framework (RPF)**.
- Resettlement has to be accomplished in consultation with the affected people and according to international standards.
- Stage 1 RAP and RPF provide for retroactive measures for people already resettled.

Resettlement and Social Impacts: Risks

- The ESIA identifies social risks:
  - **Involuntary resettlement**;
  - **Influx of workers from outside the project area**.
- These impacts need to be better understood, and required actions to minimize the impacts need to be designed and implemented.

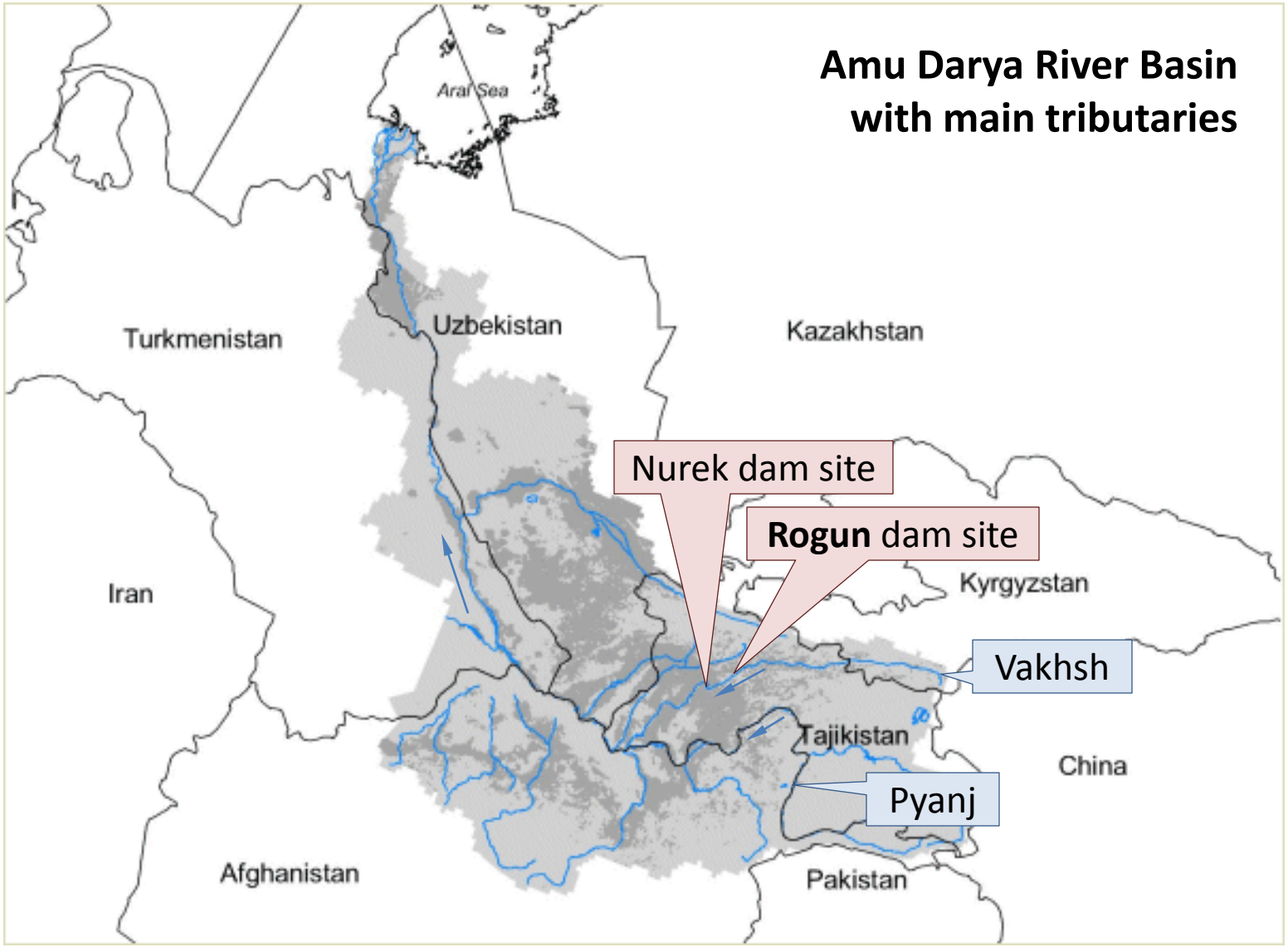
Resettlement and Social Impacts: Opportunities

- Rogun HPP has been identified as the best way for closing the gap in **winter energy supply** in Tajikistan, improving the living and socio-economic conditions of the population of the entire country including jobs and economic stimulation resulting from large scale works and infrastructure.

Water

- The Amu Darya is the **largest river of Central Asia**, and one of the two main tributaries of the Aral Sea.
- The Vakhsh contributes an average of about **26% of the annual Amu Darya flow**, and the Pyanj about 40%.
- In the Amu Darya as in the Vakhsh, the flow pattern is highly seasonal, with **high flow in summer** due to snow and glacier melt and **low flow in winter**.
- Both the Vakhsh and Pyanj carry **high sediment loads**, in the case of the Vakhsh in the range of 60 to 100 million m^3 per year at the Rogun site.

Water


Amu Darya River Basin
with main tributaries
Aral Sea
Turkmenistan
Uzbekistan
Kazakhstan
Nurek dam site
Rogun dam site
Kyrgyzstan
Iran
Vakhsh
Tajikistan
China
Pyanj
Afghanistan
Pakistan

Water: Water Allocation and Use

- In practice, water **allocations among riparian countries** are calculated seasonally by BVO Amu Darya based on the countries' requests and forecasts.
- BVO presents these to ICWC members for approval. Seasonal adjustments may be made by ICWC.
- To date, Tajikistan has **not used its full allocated water share**. Between 2005 and 2011 the average annual unused Tajik share from the Vakhsh river was 1.2 km^3.
- In future, Tajikistan **intends to use its full water**, respecting the downstream water requirements as allocated by ICWC, with or without the Rogun project.

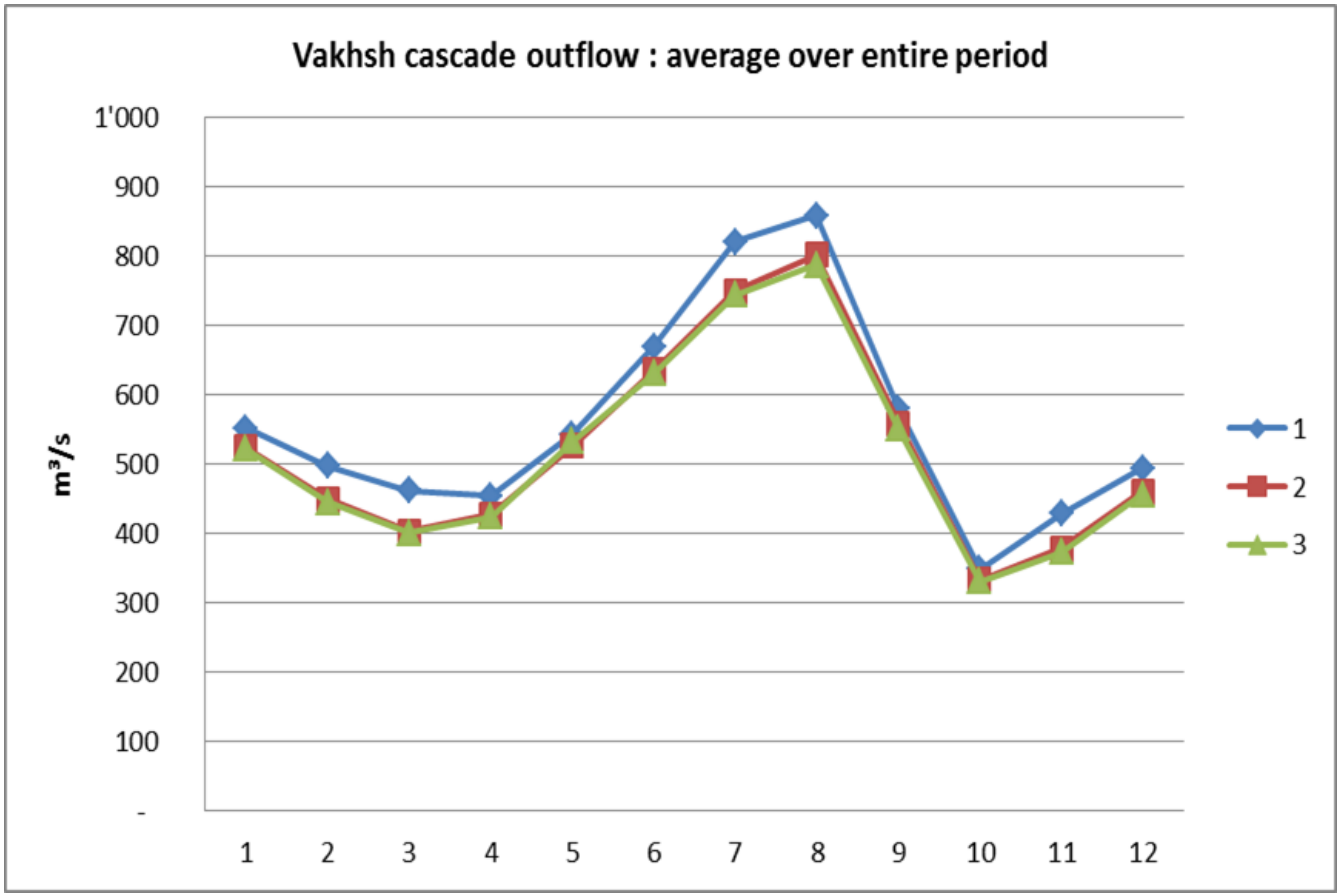
Water: Reservoir Filling

- The Government's intent is to fill the Rogun reservoir using part of the share allocated to Tajikistan under current agreements and practices.
- For the initial filling of the Rogun reservoir, Tajikistan will use its **unutilised share of water** allocated to it by ICWC, remaining in compliance with Nukus Declaration, Protocol 566 and the average limits set by the ICWC.
- This hitherto unused share would be sufficient to fill the reservoir during 16 years filling phase.

Water: Reservoir Operation

- For the operational phase of the Rogun project, it is the Government's intent to limit the transfer of water from the vegetative season inflows at Rogun to the non-vegetative season releases downstream of Nurek to **4.2 km^3**, which is the quantity currently transferred by the operation of the Nurek reservoir utilizing its present live storage capacity.
- The TEAS simulations are based upon this operating regime, which would **not change the current downstream flow pattern**.

Present and future outflow from Vakhsh cascade

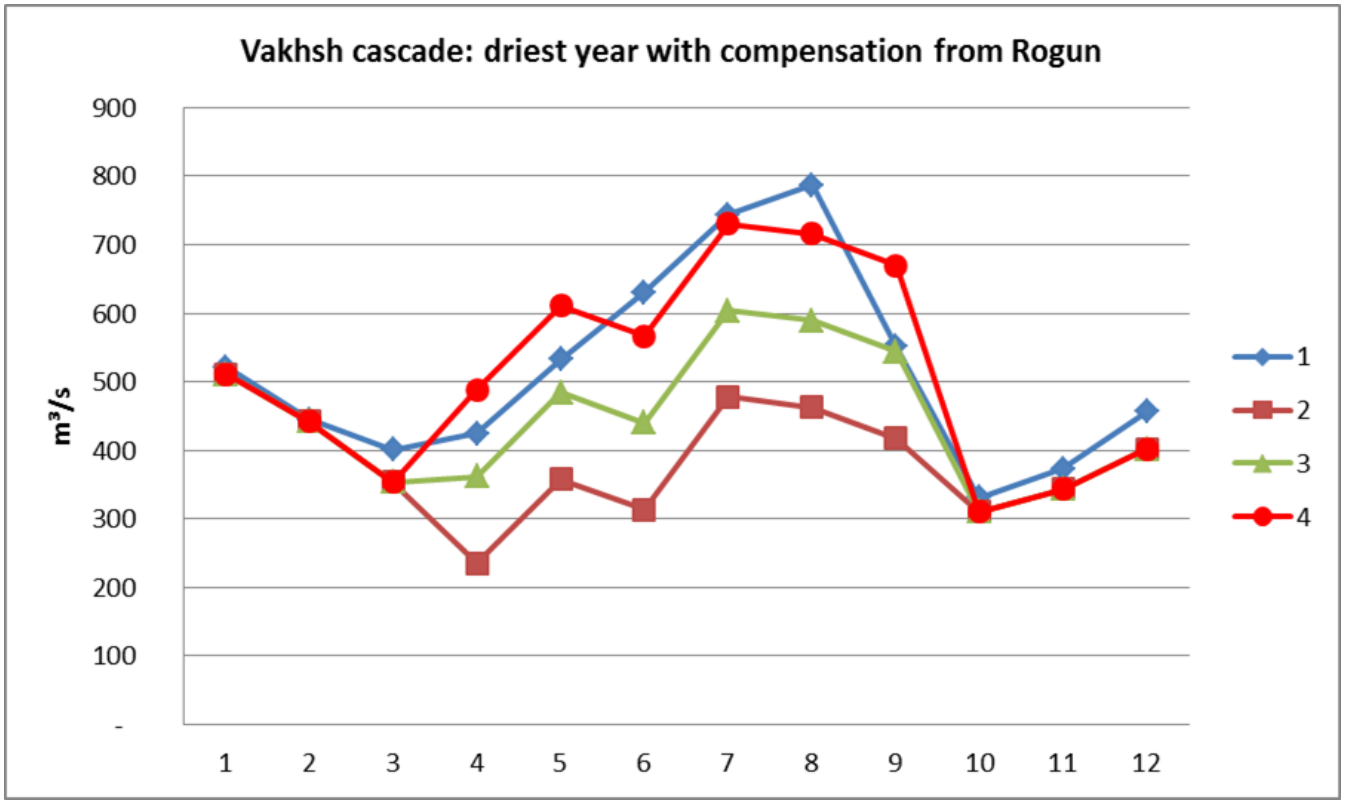


1. Present, without Rogun
2. Future, Tajikistan using its full water share for irrigation, without Rogun
3. Future, Tajikistan using its full water share for irrigation, with Rogun

Water: Risks and Opportunities

- ESIA examined a number of scenarios, including the possibility of **maximising winter energy**.
- The best option for operating the reservoirs would be the **intended operation** pattern, both for Tajik as well as the downstream countries' interests .
- Rogun HPP could benefit all downstream water users in the Amu Darya basin by providing **additional water** for irrigation in exceptionally dry years.
- **Modifications of existing agreements and practices** would allow for such an improvement.

Dry year, compensation from Rogun HPP



1. Vakhsh flow in average year
2. Vakhsh flow in dry year
3. Vakhsh flow in dry year, additional 2 km³ made available from Rogun reservoir
4. Vakhsh flow in dry year, additional 4 km³ made available from Rogun reservoir

Water: Flood Control

- The **Nurek HPP is not designed to handle the Probable Maximum Flood (PMF)**, and this places both the facility and downstream areas at some risk.
- Rogun is so designed and its storage capacity and water regulation capability would allow flow control so as to **protect Nurek and the downstream cascade**.
- Dam break scenarios and wave propagation studies would need to be undertaken and emergency preparedness and response plans developed prior to reservoir filling.

Water: Aral Sea

- The Aral Sea has suffered greatly due to massive irrigation schemes which were built in the 1960s, and which led to a very severe reduction of water inflow, to less than 10% of natural inflows.
- It has been shrinking very considerably, and salinity has increased. The southern part, alimented by the Amu Darya, is significantly degraded, with **no identified solution for recovery** in the foreseeable future.
- During the filling phase, Vakhsh flow will be reduced. Inflow to the Aral Sea will decrease by 15% in an average year, with nearly **no environmental impact**.

Water: Conclusions

- The technical and environmental studies demonstrate that it is possible to operate the Vakhsh cascade with Rogun in a way that the river **flow pattern downstream of the cascade will remain unchanged**.
- Under these assumptions, building and operating Rogun HPP will **not reduce water shares allocated to downstream riparians**.

Climate Change

- There is no significant difference in mean annual or monthly precipitation predicted.
- **Mean annual flow** in glacier fed rivers are predicted to **increase** until about 2080 and **then decrease**.
- The variability of annual mean river flows is predicted to increase towards the end of the 21st century.
- Maximum daily river flows are likely to increase.
- Overall sediment load in rivers might increase due to mobilisation of glacial sediments.
- Rogun HPP provides **opportunity to mitigate adverse effects of climate change** on downstream areas.

Main Recommendations: Effects on Riparian Countries

- The intended **operation mode** should be clearly defined and disclosed.
- An **independent technical and operational audit** of the present Vakhsh basin hydrological monitoring system should improve its reliability, and its output data should be made publicly.
- Dam failure needs to be addressed in the form of an **emergency preparedness plan**, as outlined in the ESMP.
- It is recommended that the ICWC member states modify existing agreements and practices to include Rogun operation **to maximise benefits** for all parties.

Main Recommendations: Resettlement

- **Resettlement Action Plans (RAP)** should be prepared in accordance with international standards (WB OP 4.12).
- It is not acceptable to impose a ban on construction.
- A **Resettlement Policy Framework** takes into account national resettlement policies as well as OP 4.12.
- The detailed resettlement procedure is presented in the Stage 1 Resettlement Action Plan (RAP).
- Special efforts will be required for **vulnerable groups**.
- **Training** in agriculture, coking and embroidery etc. should be considered.
- A **Witness NGO** should be selected.