

### Scenarios - overview

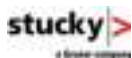
Assumption	Green Growth	Reduced/Optimized HPP Maximization Scenario	Full HPP Maximization Scenario
Domestic Water Supply	Private investment in HPPs is limited. Private demand is limited.	Private and future investment in HPPs is limited.	Private and future investment in HPPs is unlimited.
Industrial Water Supply	Private demand is limited.	Private and future investment in HPPs is limited.	Private and future investment in HPPs is unlimited.
Integrated Supply	Private demand is limited.	Private and future investment in HPPs is limited.	Private and future investment in HPPs is unlimited.
Hydropower	Private HPP is developed according to market conditions.	Regulated HPP: "Tegare" HPP, "Dubravica" HPP, "Kozluk" HPP, "Brodarevo" HPP, "Rekovići" HPP, "HPP - Lin and Gornji" HPP.	Regulated HPP: "Tegare" HPP, "Dubravica" HPP, "Kozluk" HPP, "Brodarevo" HPP, "Rekovići" HPP, "HPP - Lin and Gornji" HPP.
Other Power Sources	Other power sources are developed as needed.	Other power sources are developed as needed.	Other power sources are developed as needed.
Flood Regulation	Private flood regulation is limited to HPPs in the main water catchment area.	Private and future flood regulation is limited.	Private and future flood regulation is unlimited.
Water Quality	Maximum water quality is maintained in catchment area.	Maximum water quality is maintained in catchment area.	Maximum water quality is maintained in catchment area.
Minimum Environmental Risk	Minimum environmental risk is guaranteed for each HPP.	Minimum environmental risk is guaranteed.	Minimum environmental risk is guaranteed.
Energy	Private HPP investment is limited to HPPs in the main water catchment area.	Maximum influence on energy production is limited.	Maximum influence on energy production is unlimited.
Climate Change and Energy Integration	Private HPP investment is limited to HPPs in the main water catchment area.	Private and future investment in HPPs is limited.	Private and future investment in HPPs is unlimited.



### Selected scenario – generation/costs

#### REDUCED – OPTIMIZED HPP MAXIMIZATION SCENARIO

HPP / SHPP	Ni (MW)	Ean (GWh)	Costs (mil. EUR)
"Rogačica"	113	420	217
"Tegare"	121	452	253
"Dubravica"	87.2	333	281
"Kozluk"	88.5	395	290
"Brodarevo I"	26.1	101	75
"Rekovići"	7.20	34.5	20
TOTAL	443	1,735.5	1,136



## Selected Scenarios – Env. and social main impacts

- Topography
- Geology and Soils
- Climate
- Air Quality
- Hydrology
- Hydraulic regime of the River
- Ground water level
- Surface Water Quality
- Ground water Quality
- Terrestrial Vegetation and related habitats
- Migration corridors
- Terrestrial Fauna
- Alluvial ecosystems
- Aquatic Ecosystems
- Conservation Areas
- Landscape

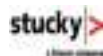
□ Impact assessment matrix for each HPPs for construction and operation phase **without mitigation measures**

□ Scoring of the overall impacts

LEGEND	
Very high positive	4
High positive	3
Medium positive	2
Small positive	1
Insignificant	0
Small negative	-1
Medium negative	-2
High negative	-3
Very high negative	-4

- Population
- Agriculture
- Forestry
- Fishing/Hunting
- Water Resources/Use
- Infrastructure
- Energy Sources/Use
- Health
- Education
- Ethnicity/Culture
- Visual Aspects
- Cultural Heritage/Tourism

**Scoring for the 3 HPPS scenarios**  
⇒ weight application in the Multicriteria analysis

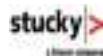


## Selected Scenarios – Water quality

### Parameters

Location	HPP Dubravica	HPP Tegar e	HPP Rogaci ca	HPP Kozluk	HPP Drina I	HPP Drina II	HPP Drina III	HPP Brodaroe vo I
Volume mil. m3	-	-	-	49.8	85.0	120	160	4.0
Qsr (m3/s)	340.4	333.5	332.0	369.0	372.5	384.6	385.1	72.3
Ret. time (days)	negl.	negl.	negl.	1.6	2.6	3.6	4.8	0.6
NO <sub>3</sub> -N (mg/L)	0.500	0.500	0.500	0.780	0.780	0.780	0.780	0.500
NH <sub>4</sub> -N (mg/L)	0.076	0.076	0.076	0.058	0.058	0.058	0.058	0.080
PO <sub>4</sub> -P (mg/L)	0.032	0.032	0.032	0.030	0.030	0.030	0.030	0.032
DIN/SRP	17.8	17.8	17.8	27.9	27.9	27.9	27.9	18.4
TN/TP	8.6	8.6	8.6	20	20	20	20	10.1

- Change from lotic towards the lentic conditions;
- Significant eutrophication potential in some cases
  - Realization will depend on retention time and thermal stratification conditions



## Selected Scenarios – Water quality main impacts

### Parameters

Location	HPP Rogacica	HPP Tegare	HPP Dubravica	HPP Kozluk	HPP Drina I	HPP Drina II	HPP Drina III
Volume mil. m <sup>3</sup>	-	-	-	49.8	85.0	120	160
Qsr (m <sup>3</sup> /s)	332.0	333.5	340.4	369.0	372.5	384.6	385.1
Ret. time (days)	negligi	negligi	negligib	1,6	2,6	3,6	4,8

Location	HPP Brodarevo I	HPP Brodarevo II	HPP Rekovici
Volume mil. m <sup>3</sup>	4,0	10,3	0,5
Qsr (m <sup>3</sup> /s)	72,3	72,3	88,0
Ret. time (days)	0,64	1,7	-

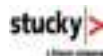
## Selected Scenarios – Social main impacts

### Construction and operation phases – Negative impacts

- Population (inundation and resettlement)  
The planned HPPs and their reservoir will be located in municipalities Bajina Bašta, Ljubovija, Loznica, Bogatić, Prijepolje and Priboj.
  - The construction of HPP “Brodarevo II” and several HPPs in the middle and lower Drina will require resettlement of households, both in Serbia and R. Srpska.
- According to the preliminary analysis in the Serbian part of the DRB (SR IB no. 28 and SR IB no 26) approximately 100 km of state roads are placed next to the river banks. It is estimated that about 15% would be flooded by proposed developments.
- Touristic manifestations (e.g. Drina Regatta) could be affected.

## Selected Scenarios – Env. and social main impacts

Parameter / Indicator	OVERALL IMPACT ASSESSMENT DURING OPERATION STAGE									
	Max HPP #1	Max HPP #2	Max HPP #3	Max HPP #4	Max HPP #5	Max HPP #6	Max HPP #7	Max HPP #8	Max HPP #9	Max HPP #10
Ref.No										
Name of HPP	HPP, "Brodevaro I"	HPP, "Brodevaro II"	HPP, "Relovci"	HPP, "Toplica"	HPP, "Tigara"	HPP, "Dubravica"	HPP, "Kostul"	HPP, "Drima I"	HPP, "Drima II"	HPP, "Drima III"
ENVIRONMENT IMPACT										
Geology and Soils	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1
Climate	0	-1	0	0	0	0	-1	0	0	0
Air Quality	0	0	0	0	0	0	0	0	0	0
Hydrology	0	1	0	1	1	1	1	2	2	2
Hydraulic regime of the River	-2	-3	-1	-3	-3	-3	-2	-2	-2	-2
Surface Water Quality	0	0	0	0	0	0	-1	-1	-1	-1
Groundwater Quality	0	0	0	0	0	0	0	0	0	0
Terrestrial Vegetation and related habitats	-3	-2	-1	-1	-1	-1	-1	-3	-3	-3
Migration corridors	-3	-3	-1	-3	-3	-3	-3	-2	-2	-2
Terrestrial Fauna	-1	-2	-1	-1	-1	-1	-1	-2	-2	-2
Aquatic ecosystems	-1	-2	0	-1	-1	-1	-2	-3	-3	-3
Aquatic Ecosystems	-4	-4	-1	-4	-4	-3	-2	-2	-2	-2
Conservation Areas	0	0	0	-1	0	-1	0	0	0	-3
Landscape	-2	-2	-1	-2	-2	-2	-2	-2	-2	-2
<b>Development Scenario</b>	<b>Total score of environmental Impact</b>		<b>Value of environmental impact function</b>				<b>Rank-Environmental Impact</b>			
Water management/financial Impact Criterion										
<b>Reduced/Optimized HPP Maximization Scenario</b>	-19		-19.000				1			
<b>Full HPP Maximization Scenario</b>	-36		-36.000				2			
Education	0	0	1	0	0	0	1	0	0	0
Ethnicity/Culture	0	0	0	0	0	0	0	0	0	0
Visual Aspects	-1	-1	0	1	1	1	-1	0	0	0
Cultural Heritage/Tourism	0	0	0	2	0	1	-1	0	0	0



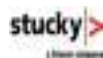
## Selected Scenarios – Mitigation measures

The most of considered impacts can be partially offset or completely mitigated by adopting the measures implemented in the mitigation plan during the construction and operational phases of the planned development.

Examples of mitigation measures:

- o Guarantee of a minimal e
- o Construction of adapted
- o Management of fish stock
- o Monitoring of aquatic ec
- o Monitoring of flora and c
- o Control hydropeaking an
- o All liquids , material and
- o suitable stored and tr
- o Employment of local pop
- o Improving of local infrastr
- o Education programs
- o Improving of supply of loc

Indicator	Main expected impact	Recommendation/mitigation measures	Responsibility
Water quality	Eutrophication processes, accidental pollution (during maintenance work)	<ul style="list-style-type: none"> <li>• Broader water management activities, including waste and wastewater management, erosion control, etc. All hazardous material manipulation activities have to be conducted at designed and equipped locations;</li> <li>• A dispatch plan of the water release with the relative constant water level as the main criteria. Relative stability of the water surface level is very important for the preservation of the integrity and stability of the lake ecosystem, especially in small water basins.</li> <li>• Macrophyte bio-manipulation where required.</li> <li>• Liquid wastes/oil/chemicals to be stored in tanks or drums located in bounded areas which can hold 110% of the total storage volume.</li> <li>• Spill kits to be available at all times.</li> </ul>	Contractor and relevant Stakeholders



### Scenarios – links with other countries-transboundary issues, coherence

- Selected scenario for Serbia – includes 3 HPPs on middle Drina ("Dubravica", "Tegare" and "Rogačica" ) and 1 HPP on lower Drina ("Kozluk") - transboundary HPPs – sharing potential with BiH
- Selected scenario in BiH includes none of these plants
- In present situation potential is already been shared between Serbia and BiH on two HPPs ("Bajina Bašta" and "Zvornik")
- The scenario can not be further developed without agreement of two riparian countries - it is recommended that all involved parties should harmonize their interests regarding the construction of the HPPs that produce electricity based upon the shared potential

### Monitoring – Present situation

- 10 hydrologic stations governed by RHMZ
- 44 meteorological stations governed by RHMZ
- 7 meteorological stations governed by EPS
- a certain number of other stations "outside" the system
- active (or possible) access to "Drina" HIS
- WISKI used by RHMS

## Monitoring – Goals

- coverage of the Serbian part of DRB with an adequate number of stations
- improvement of measurement process on existing stations
- improvement of data exchange within the basin
- all stations should cover the minimum set of measurement parameters
- general goal is for the time step not to exceed 1 hour (although, 10, 15 or 20 minutes can be desirable in some cases)
- it is necessary to check existing equipment and structures
- list of proposed stations reflect stakeholders' and consultant's views

## Monitoring – Proposed changes

- improvement of 2 meteorological stations in the Lim RB
- dedicated methodology was used for proposed introduction of new stations
- some of the criteria used were spatial and height distribution, connectivity and accessibility
- 1 new hydrologic station along Drina river
- 1 new hydrologic station in the Lim RB
- 3 new meteorological stations in the Lim RB
- 1 new hydrological and 1 new meteorological station in the sub-basin between "Višegrad" HPP and "Bajina Bašta" HPP
- 3 new hydrological and 2 new meteorological stations in the sub-basin between "Bajina Bašta" HPP and "Zvornik" HPP