



This project is funded  
by the European Union

# REGIONAL HYDRO MASTER-PLAN (Hydropower Development Study in the Western Balkans)

## Approaches for the development of a Hydropower Master Plan for the Balkan region

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RECG @ ECS Vienna, 10 November 2016

## Why?

- Considerable untapped hydropower potential in Europe
- Slower than planned progress in the implementation of national REAPs (2011-2020) in several WB6 countries
- Coherent transboundary approach
- Optimal use of water resources – integrated river-basin and water-management plans
- New opportunities for IFIs - improved financing possibilities

## Who benefits?

- **Beneficiary WB6 countries** to prepare their own national hydro master-plans (with related SEAs) in line with EU requirements
- **EU** (incl. the ECS) to identify which projects could be eligible for potential EU co-financing
- **IFIs**, who are interested in identifying low-carbon project financing opportunities



The **overall objective** of this **regional project** (client: DG NEAR) is to **foster harnessing of environmentally and climate change sustainable hydropower generation** in the WB6 region in line with strategic objectives of the European Union and the ECT obligations of its Contracting Parties.

The **purpose** of the intervention is the development of a **study determining a list of hydro power project (HPP) development priorities** by (i) river basin (ii) individual WB6-country and (iii) type of planned HPP facilities (storage, run-of-river, reversible), through which the remaining hydro-power potential in the region will be evaluated.

Rehabilitation / reconstruction of existing HPPs are regarded as obvious top priorities for investments in realising hydropower potential

The Study will determine the possibilities for developing the remaining technical hydro-potential in the WB6 region by **taking into full consideration:**

- the constraints arising from national legislation and regulations with respect to developing of hydro power projects,
- protection of biodiversity and the environment,
- sustainability & climate change,
- spatial planning and the power sector in general.

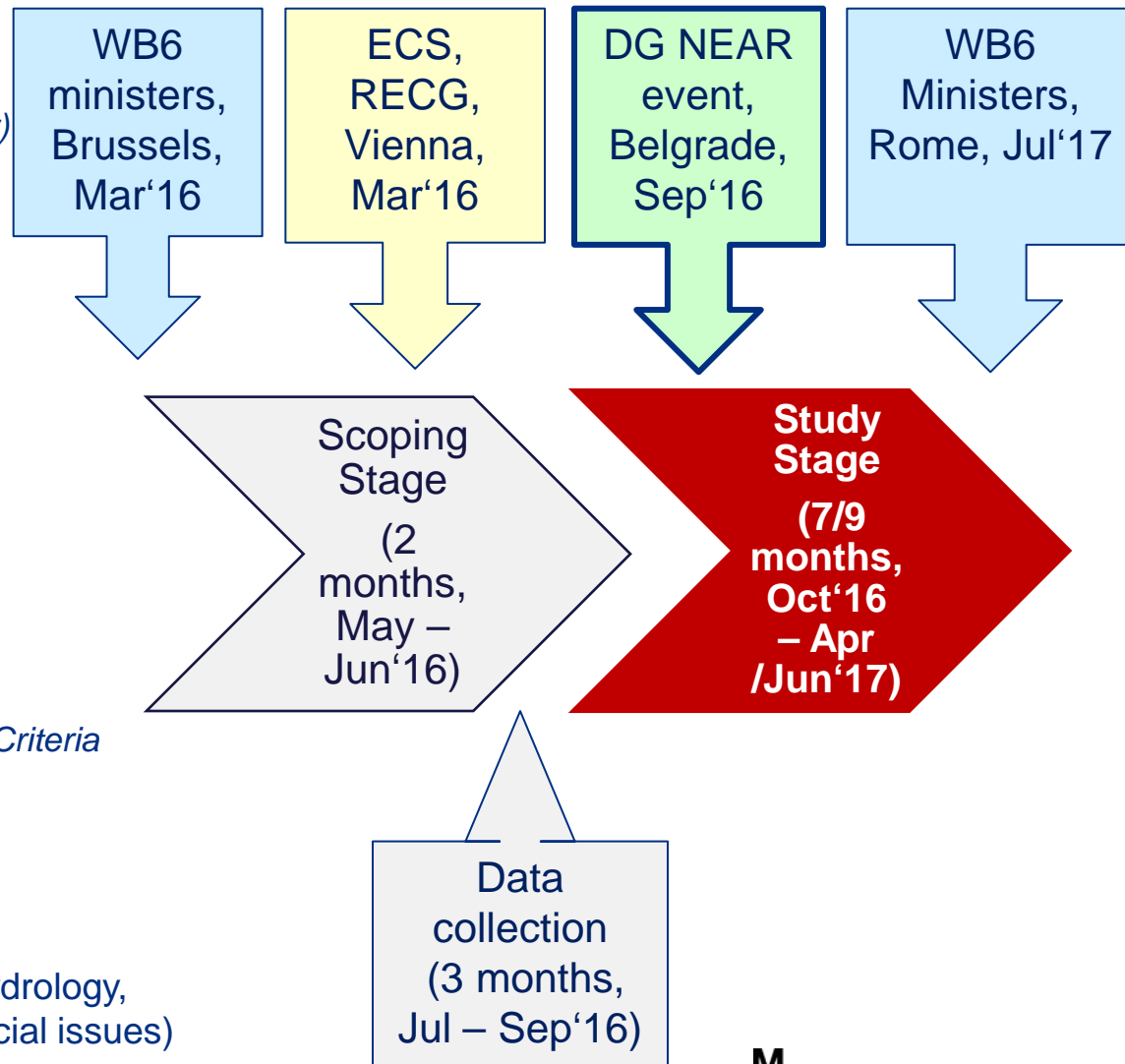
## A) Project Team Experts:

- Marko Košir  
(Hydropower Policy expert & Team Leader)
- Maja Kerovec  
(Environment expert)
- Marko Krejči  
(Hydropower Development expert)
- Božidar Radović  
(Grid Connection expert)
- Mladen Simić  
(GIS Application expert)
- Zoran Stojič  
(Hydrology & Water Management expert)
- **Energy Institute Hrvoje Požar (Zagreb)**  
(Economic & Financial Analysis and Multi-Criteria Assessment of HPP projects)

## B) Additional support experts:

- 7 Task experts (regional)
- 17 National experts (grid connection, hydrology, HPP development, environment and social issues)

In total, about **30 experts** involved.



# SELECTED SCOPING STAGE FINDINGS

1. **Draft inventory** of existing hydro power plants (all capacities)
2. **Template for a database of prospective HPP projects** that includes both “greenfield” projects and rehabilitation / reconstruction projects ( >10 MW)
3. **Situation analysis** in terms of frameworks relevant for hydropower sector development:
  - Policies and action plans (NREAPs)
  - Institutional-organisation framework
  - Legal-regulatory framework
  - Grid development issues
  - Hydrology / water management issues
  - Environmental, biodiversity, climate change and sustainability issues, and
  - Transboundary issues.
4. **Identification of data sources and cooperating partner-organisations**, initial collection of data, study reports, HPP documentation etc.
5. **Initial analysis** based on collected information from desk research and country feedback
6. **Preparation of draft Terms of Reference (TOR)** for the Study stage (Annex 1 to the Scoping Report),

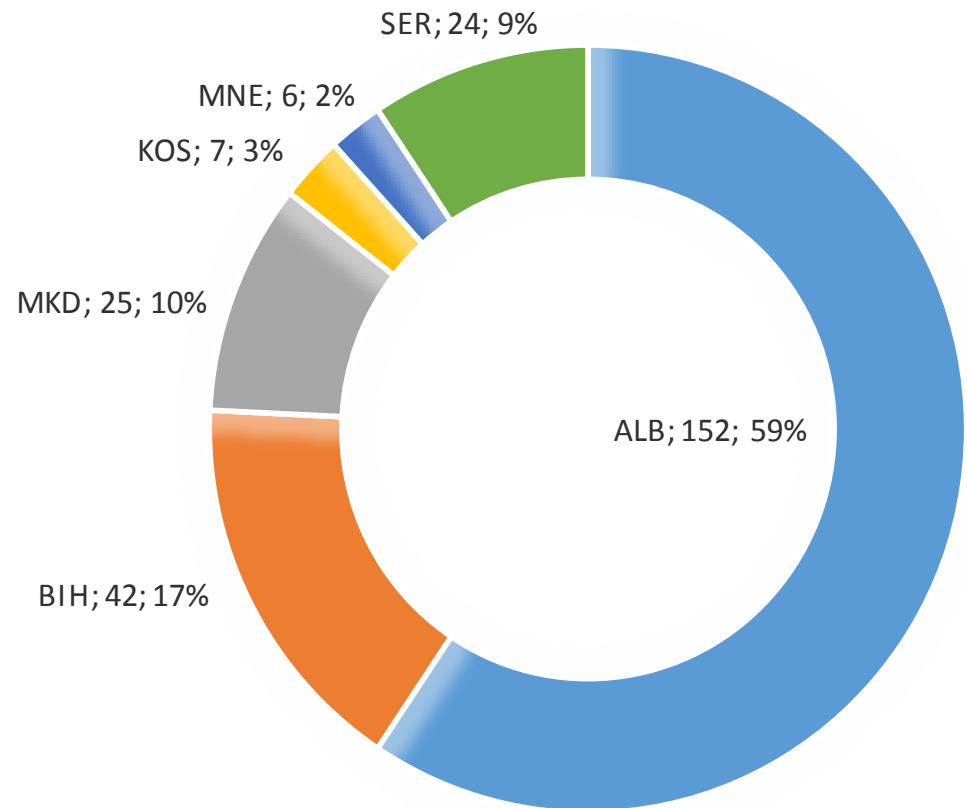
Draft Scoping report and ToR were delivered to Client - DG NEAR - on 22 June 16

Final draft Scoping report and TOR delivered to invitees of the 1st Regional Conference of DG NEAR (Belgrade, 27.9.2016) – i.e. made public

Commenting period prolonged till 31.10.2017

## Status of existing hydropower plants in WB6 (number of HPPs)

- Total number of HPPs: **256**, of which, 53 (21%) in >10 MW power plants and 203 (79%) in <10 MW power plants
- Total installed capacity in HPPs: **8,423 MW**, of which 7,994 MW (94.9%) in >10 MW units and 429 MW (5.1%) in <10 MW units
- ...or 1/5 of HPPs of >10 MW represents approx. 95% of all HPP capacities in WB6
- In terms of number of HPPs, Albania highly dominates in the region with 59% because as many as 68% of small HPPs are currently located there.



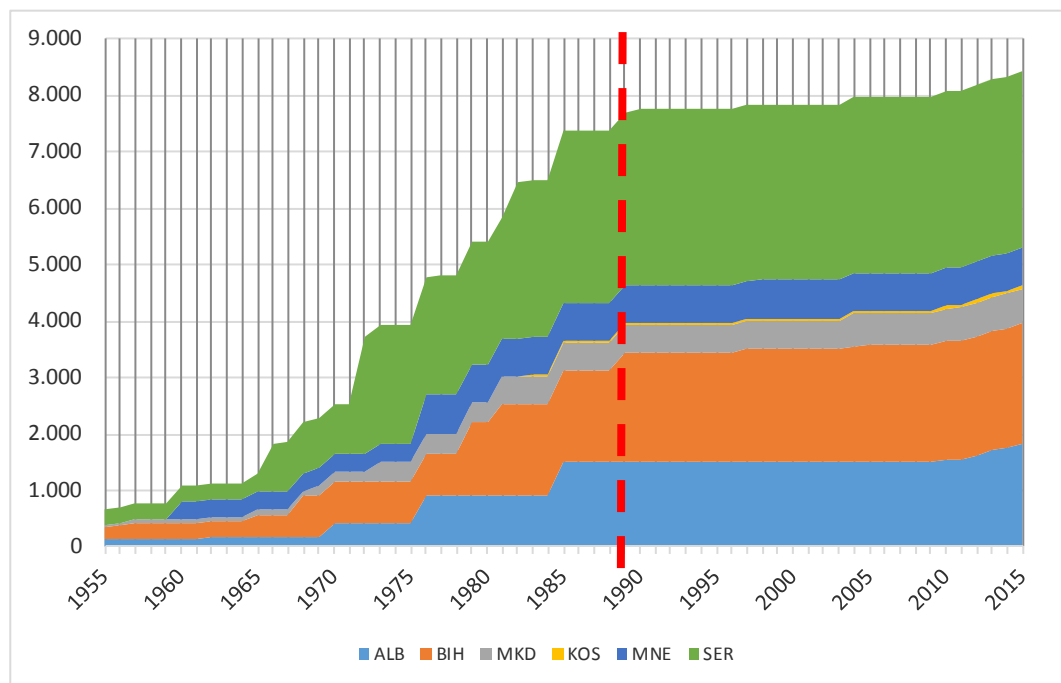
Number of HPPs by country and percentage in the WB6- total no. of 256 (100%), status as of end-May 2016



# Scoping Stage – Selected results, conclusions and observations (iii)

## Dynamics of HPP commissioning in WB6 (1955-2015) (MW)

1990



Development of cumulative HPP capacities in the WB6 (1955-2015), MW

Average HPP-capacity addition achieved during 1955-1990 was **203 MW per annum** while in the period 1990-2015 it dropped to mere **26 MW per annum**.

Reasons can be attributed to:

- “Best” HPPs already implemented,
- Disintegration of former SFRJ followed by wars in the '90s,
- End of central planning and coordinated water management, lack of cooperation between newly established states,
- Lack of financial capacity of power utilities / states for investment intensive projects,
- Growing investment risks in emerging market conditions, and
- Continued unresolved transboundary issues.

## Hydrology and water management issues

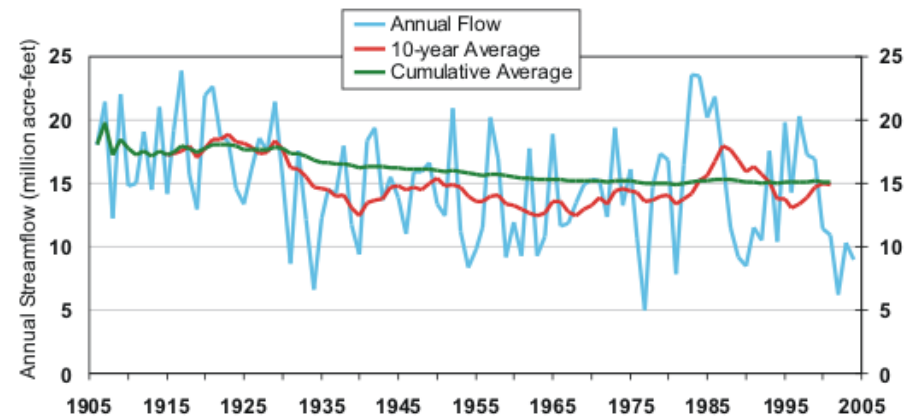
### Hydrology baseline data and water management related information enable quality energy production estimations

- River discharge data are critically important to determine hydropower capacity.
- There are many examples of **poor hydrology data** resulting in overestimated or underestimated energy potential compared with real situation.
- Official hydrology data should be reviewed, properly evaluated and, if necessary, revised in order to determine the realistically available hydropower potential.



### Regional hydrology database has to be established including an effective data management system and appropriate statistical analysis

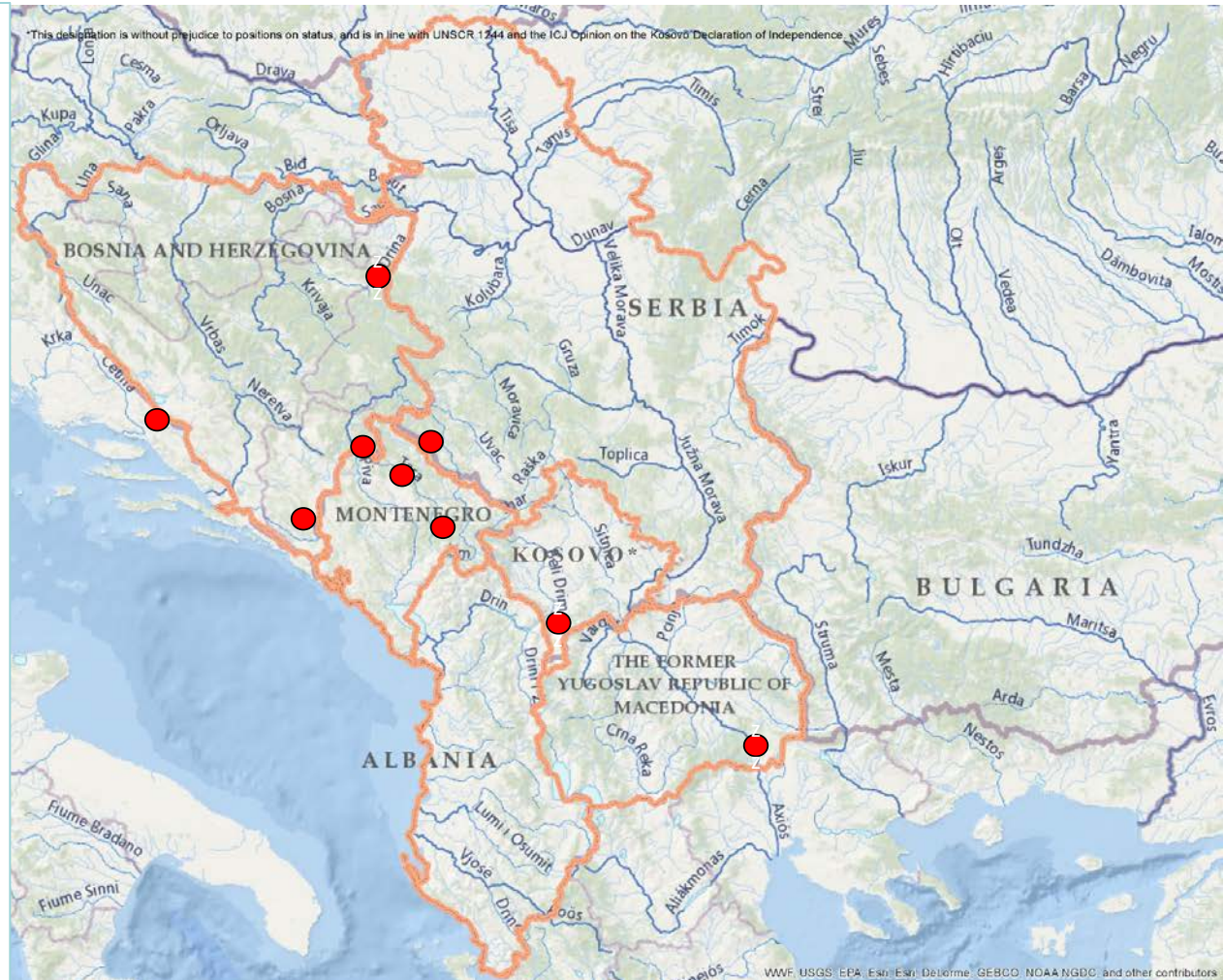
- It is of utmost importance to apply the **most recent hydrology** i.e. water flow data, as the consequence of **climate change** effects has caused strong surface run-off pattern changes in recent years.



## Transboundary issues

**Transboundary aspects of hydropower on rivers will be identified and elaborated for optimum power and multipurpose effects.**

- A significant number of planned HPP projects (approx. 10) are shared between several WB6 countries.
- HPPs from former Yugoslavia that were planned in non-transboundary conditions became blocked by new political map.
- Hydropower optimisation in cases of shared water resources should be prepared together with corresponding guidance on associated legal matters.



## Environmental issues

- River ecosystems in the Western Balkans are:
  - Predominantly in good health
  - Typically with high biodiversity
  - However, face a high number of planned hydropower projects
- **Environmental risk must be assessed well in advance, managed and mitigated**
- Risk assessment for Huchen (*Hucho hucho*) or Danube Salmon in core transboundary geographic areas:
  - Una River along the Croatian-Bosnian-Herzegovinian border,
  - the upper Drina River and its tributaries in Bosnia-Herzegovina and Serbia, and
  - the Lim River in Montenegro.



# SELECTED STUDY STAGE TASKS



# Terms of Reference – Study Stage

## Scope of Work (i)

- Task 1: Hydropower role (past and future) in the regional and national context
- Task 2: Assessment of the current situation in the institutional-organisational framework relevant for hydropower development
- Task 3: Assessment of the current situation in the legal-regulatory framework relevant for hydropower development
- Task 4: Assessment of hydrology baseline, water-management by country and by river basin with transboundary issues
- Task 5: Grid connection issues in network development context
- Task 6: Identification of HPP projects and acquiring relevant information for the HPP inventory and investment planning
- Task 7: Environmental, Biodiversity and Climate Change Analysis on (i) river basin level and (ii) country-level of identified hydropower schemes

**ANNEX I: DRAFT TERMS OF REFERENCE**  
 REGIONAL HYDRO MASTER-PLAN  
 (Hydropower Development Study in the Western Balkans)  
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# Terms of Reference – Study Stage

## Scope of work (ii)

- Task 8: Establishment of the central GIS database
- Task 9: Development of a web-based GIS application
- Task 10: Multi-Criteria Assessment (MCA) of prospective HPP projects
- Task 11: Drafting of Regional Action Plan on Hydropower Development and compilation of Final report on the Study
- Task 12: Establishment of IT-supported Information and Document Management System (IDMS)
- Task 13: Training and dissemination of Study results

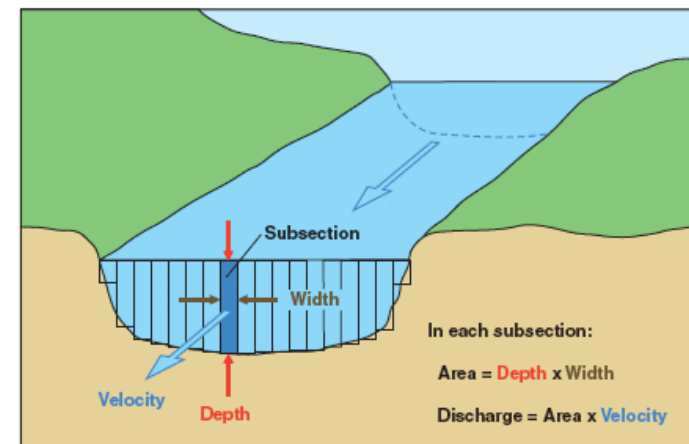
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## Study Stage - Hydrology, water management and transboundary issues

- **Relevant studies will be collected and reviewed** in order to bring flow data to the same level. The quality of the data that is available has to be thoroughly cross-referenced to other available sources.
- Advantages of developing **integrated and multipurpose hydropower strategies** will be assessed both at the river basin as well as individual country level.
- River flow data across the region will be prepared in various forms, while applying variety of approaches. All **hydrology and metrology data has to be checked** and classified accordingly.
- It is important that **delivery of requested data from the relevant institutions is done efficiently** within the short time available in the Study Phase.
- **Climate change** impact on run-off hydrology has to be assessed if reliable discharge data are to be obtained for the planning of future HPPs.
- **Methods of dividing water resources in shared rivers**, especially regarding discharge and water head need to be developed and promoted to assist transboundary water use negotiations in the WB6 region.

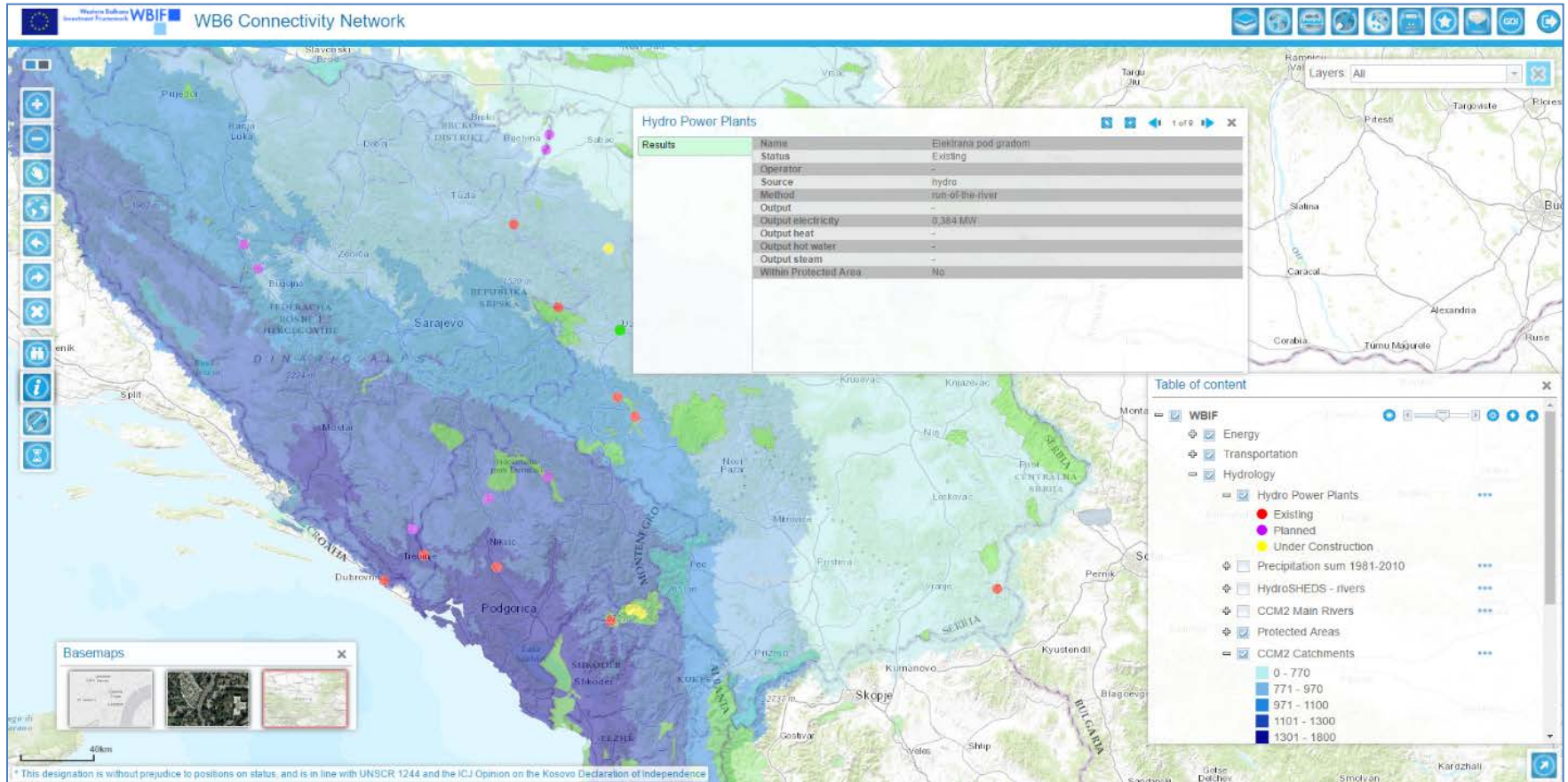


Current-meter discharge measurements are made by determining the discharge in each subsection of a channel cross section and summing the subsection discharges to obtain a total discharge.



- The Study will provide a **neutral assessment of pros and cons of development of hydropower potential at river basin level** (and subsequently by country).
- **Main environmental impacts will be identified and mitigation measures** to reduce the impact will be recommended, such as:
  - Ecologically acceptable flow (EAF) - reducing the impact of dams on fisheries,
  - biodiversity / habitat / protected areas preservation & protection – e.g. fish paths, establishment of “no-go” zones
  - resettlement / land acquisition,
  - downstream effects and transboundary effects,
  - cumulative effects – on river basin scale (water flow, sediments, fish migration),
  - effect of climate change on catchments, accumulations and habitat, etc....

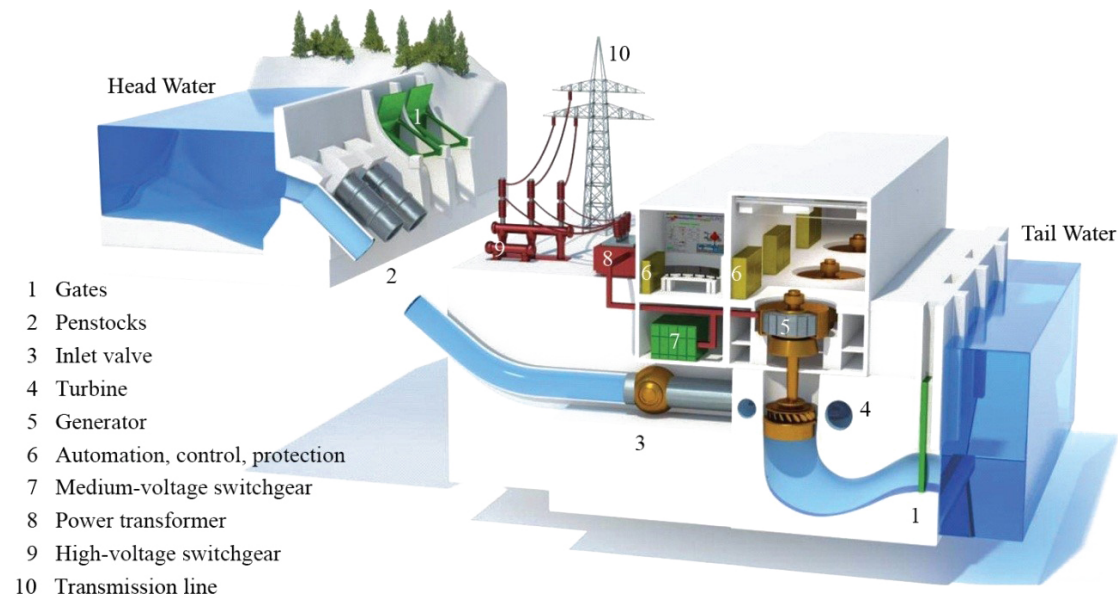




- G/1 Relevant HPP-related **central GIS database** is established and Hydropower Development Study GIS (HDS-GIS) application is developed, populated with data and operational. The **HDS-GIS application** includes maps / several layers that facilitate HPP projects planning and presentation.

# INVENTORY OF HPP PROJECTS (HMP-DB) AND MULTI-CRITERIA ASSESMENT OF HPP CANDIDATE PROJECTS

- In most of the WB6 countries there is extensive experience in developing, constructing and operating HPPs. HPP technology used to be „export product“ of the former SFRJ
- Based on various publicly available sources almost **300 hydro-power projects larger than 10 MW** were identified by the project
- Many of the identified projects are being repeatedly mentioned in strategic planning documents for decades, however without visible progress in practice

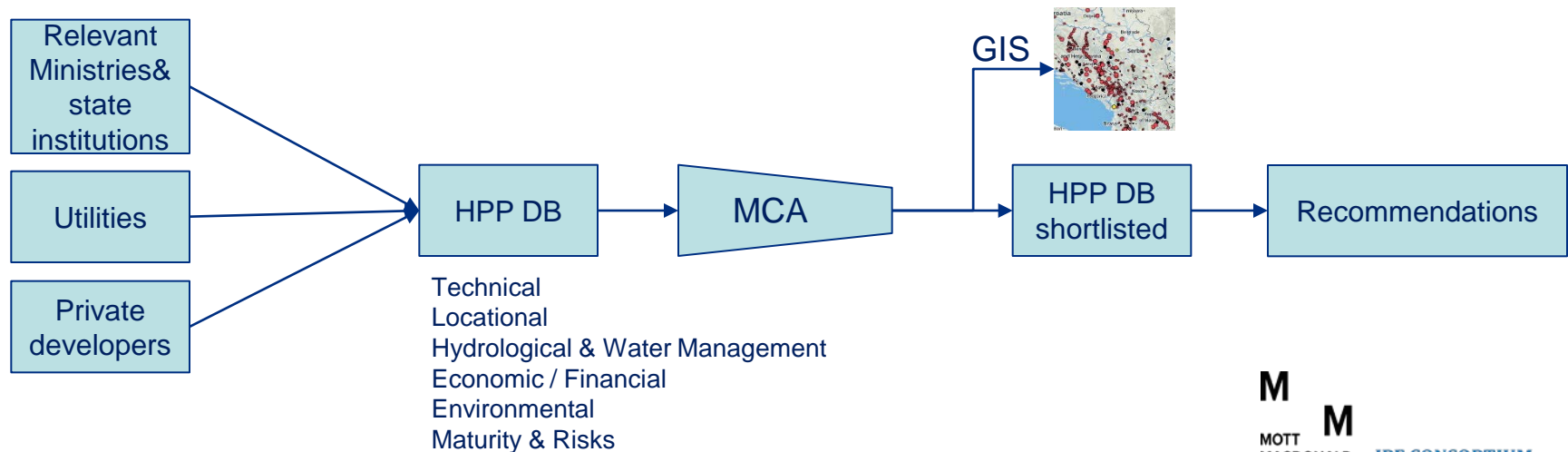




# INVENTORY OF HPP PROJECTS (HMP-DB) AND MULTI-CRITERIA ASSESMENT OF HPP CANDIDATE PROJECTS

## Identified projects will be analysed and shortlisted

- A methodology for **multi criteria assessment** (MCA) of candidate HPP projects will be developed and the long-list of projects scrutinized from **environmental, technical, hydrological, economic / financial, and implementation maturity** point of view.
- Based on MCA, a short-list of projects that are promising candidates for implementation will be developed. These will be organized in several groups according to their justification, possible conditionalities and financial attractiveness for implementation.
- Particular attention will be devoted to the transboundary projects and issues of integrated river basin management.

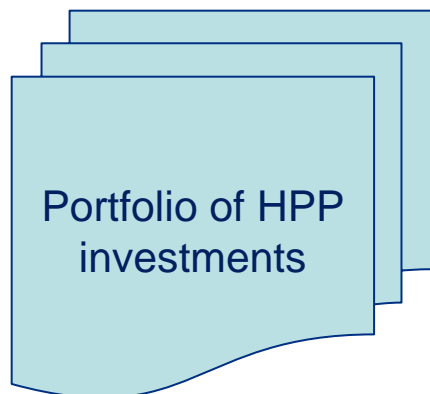


# INVENTORY OF HPP PROJECTS (HMP-DB) AND MULTI-CRITERIA ASSESSMENT OF HPP CANDIDATE PROJECTS

## Selected planned results

### Portfolio of HPP investments, the remaining hydropower potential, associated recommendations and the associated Action Plan

- Portfolio of HPP investment projects grouped according to their investment attractiveness (based on MCA), with key information on each individual project presented in a comparable format
- Total power generation capacity of a portfolio of HPPs will indicate the practically remaining hydropower potential in large HPPs (> 10MW)
- Smaller (<10 MW) hydropower potential will be presented in an aggregated form by country
- Recommendations for streamlining the development of the projects will be provided



Practically remaining HPP potential



## Selected observations on the nature of received comments

The project is regularly updating a master document of received comments and our responses that we will keep under consideration during the implementation of the study (some 40-p. document at present).

- Most parties entirely focus on issues of their individual concerns without observing the required balanced approach of the study – only few comments address the whole report or ToR
- The institutions are insufficiently informed about developments in their non-core areas of responsibilities (while the study has to ensure the proper balance)
- There are visible attempts to integrate country-specific issues in the study programme rather than pursue the required “regional” dimension of the approach clearly asked for by the client (DG NEAR)
- Integrated water management plans concepts promoted by the Water Framework Directive are still insufficiently embedded in minds of national authorities
- Despite poor progress in hydropower scene in the last 2-3 decades in WB6 Some developers (e.g. public utilities) still prefer to express reservations and objections to cooperate actively with the consultant. Can disclosure of typical techno-economic data really hamper such development because the eventual investor will still make his decision on sources that he will validate himself?
- The reality that the WB6 is still not part of the EU is often neglected, which is reflected in overambitious expectations of commenting institutions. Until that time, the WB6 countries still operate in their own legal-regulatory and institutional frameworks.
- Etc.

## Selected examples of stakeholders' concerns / positions collected through received comments

- What will be the value added of the study in conditions when we have already numerous studies in our archives for some decades?
- How and should small HPPs (representing mere 10% in terms of produced energy) and 80% in terms of their number be integrated in the study? What about their contribution to the cumulative effects addressed in the study (EAF, sediments, fisheries)?
- Will results of the study be mandatory for our countries and in what respect if so?
- Will the regional master-plan be pursued as our national hydropower master-plan?
- Can the study results possibly stop our own plans and endeavours to find investors?
- Will and how the WFD and other Hydropower Development Guidelines (e.g. ICPDR, DG ENV, IFIs) be considered in the study?
- Will the master-plan provide any updates/new PFS or FS for our planned HPPs or new SEA reports?
- How will the study proceed in the prevailing conditions of absent Integrated Water Management Plans at the river basin level?
- Why is the study's approach is not based on a "country by country" basis - because we are not interested in other countries, especially non-neighbouring ones?
- How will the complex environmental criteria impact the MCA and how to ensure that all HPPs are evaluated impartially? Is such approach feasible at all?
- What is the ultimate goal of the study, who will decide on that?
- How can our interest can be adequately represented in the process of study development, will the study deliverables be available to us and how?

## WBIF-IPF 3 Consortium

Thank you for your attention!



ATKINS

[www.wbif.eu](http://www.wbif.eu)