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

Progress report

Martyn Osborn - Key Expert, Energy

Marko Kosir - Senior Project Manager & Team Leader

RECG @ ECS Vienna, 07 March 2017

The contents of this presentation are the sole responsibility of the Mott MacDonald IPF Consortium and can in no way be taken to reflect the views of the European Union.
Objective and Purpose

The overall objective of this regional project (client: DG NEAR) is to contribute to fostering the 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) type of planned HPP facilities (storage, run-of-river, reversible), through which the remaining hydro-power potential in the region will be evaluated, according to the following priority:

1. Repair, refurbishment, upgrade and rehabilitation of existing HPPs
2. Sustainable greenfield HPPs
Timeplan – important Study stages and events

**Draft TOR**
- Scoping Stage (2 months, May – Jun’16)

**Study Stage** (8/11 months, Oct’16 – May/Aug’17)
- 1st Workshop, Podgorica, 30-31.3.2017
- 2nd Workshop, Tirana, 8-9.5.2017
- Tour through all WB6 countries, 12-30.6.2017

**Final TOR**
- WB6 ministers, Brussels, Mar’16
- ECS, RECG, Vienna, Mar’16
- DG NEAR event, Belgrade, Sep’16
- WB6 Ministers, Trieste, Jul’17

**Data collection** (3 months, Jul – Sep’16 plus 6 months, Oct’16 – Mar’17)
Terms of Reference (TOR)

Minor amendments

- Partial redefinition of the objective and purpose
  - „Contribute“ to sustainable HPP development (objective)
  - Focus on (1st priority) repair, refurbishment, upgrade and rehabilitation of existing HPPs, and (2nd priority) sustainable greenfield HPPs

- Strengthen the importance of full transposition and (stepwise) implementation of EU Water Framework Directive (WFD) as policy platform for HPP planning, aiming at proposing HPP development projects consisting of:
  1. Refurbishment projects aiming at improving operational safety, HPP capacity & availability and the environment at existing HPPs of more than 10MW of capacity in the WB6 region (55 facilities)
  2. Refurbishment projects aiming at prolonging service life time of existing HPPs, where applicable, including possible improvements of the environment
  3. “Highly recommended” greenfield projects based on our Multi-Criteria Assessment (MCA) of new HPP candidates from a long-list of identified projects in the WB6 region (approx. 400).

- Amendment of task on dissemination of results:
  - 2 Workshops
  - Round-tour to all WB6-countries
Terms of Reference (TOR)

What cannot be provided by the Study

- The Study shall not address the following issues and cannot provide the following results, for which national institutions or public or private or mixed entities are typically responsible in accordance with specific national legislation or regulations in place in the WB6 countries:
  - New Integrated River Basin Management Plan (IRBMP)
  - SEA at the river basin level or programme level, EIA or ESIA at the project level
  - New (pre)feasibility studies (including technical redesign existing HPP schemes)
  - Consideration of small HPPs at the individual power plant or tributary level – no new cadastres of sHPPs
  - Quantitative assessment of cumulative effects of main rivers (in terms of water discharges, transport of sediments and fishery issue
  - National hydropower master-plan
  - “No-go” zones established
  - New comprehensive research / analysis of biodiversity and habitats ((25) River and (Sub)River Basins in the Study)

- The Study results are recommendations rather than any mandatory solutions for the WB6 countries.
Project organisation

3 type of experts

Elodie Loppe
Task Manager

Gordon Lamond
IPF3 Project Manager

Martyn Osborn
Energy Sector Key Energy Expert

Marko Košir
P1: SMP – Team Leader

Igor Jemcov
(SER)
Hydrology / Water Management

Marko Krejči
P4: Hydropower Development Expert

Maja Keroce
P5: Environmental Expert

Subcontractor 1 (GDI)
P6: HDS-GIS

Subcontractor 2 (EIHP)
P7: MCA

DG NEAR
(Client)

WBIF-IPF3
(Contractor)

(5) Core Project Team Experts (PTEs) and 2 sub-contractors (Task Leaders)

(7) Task support experts (Senior and Junior)

(18) National support experts (Senior)

WBEC-REG-ENE-01

Mihailo Burić (MNE)
Hydrology / Water Management

Konstantin Siderovski (MKD)
Hydrology / Water Management

Dragana Selmanagić (Bih)
Environment

Konstandin Siderovski (MKD)
Environment

Srdjan Vujadinović (MNE)
HPP Development

Zdravko Stefanovski (MKD)
HPP Development

Evića Rajić (SER)
Environment

Konals Gjoka (ALB and KOS)
Environment

Sma Sudar (MNE)
Environment

Edhem Bilićkić (BiH-FBiH)
HPP Development

Milan Ćušić (BiH-RS and SER)
HPP Development

Fahri Maho (ALB)
HPP Development

Nijaz Lukovac (BiH – FBiH)
Hydrology / Water Management

Naim Bejtullahu (ALB+KOS) Grid Connections

Dritan Bratko (KOS)
Hydrology / Water Management

Konstandin Siderovski (MKD)
Hydrology / Water Management

Boris Jandrić (BiH – RS)
Hydrology / Water Management

Mol纳r Kolanc (ALB)
Hydrology / Water Management

Edhem Bilićkić (BiH-FBiH)
HPP Development

Naim Bejtullahu (ALB+KOS) Grid Connections

Tomaž Lajovic
Task 4

Luka Javnik
Task 4

Naím Bejtullahu (ALB+KOS) Grid Connections

Božidar Radović
P2: Grid Connection Expert

Zoran Stojić
P3: Hydrology / Water Management Expert

Marko Krejči
P4: Hydropower Development Expert

Kristjan Honet
Task 6

Rober Špendl
Task 12

Daša Zabrić
Task 7

Milos Golubović
Task 8-9

Mihailo Burić (MNE)
Hydrology / Water Management

Igor Jemcov (SER)
Hydrology / Water Management

Mihailo Burić (MNE)
Hydrology / Water Management

Mihailo Burić (MNE)
Hydrology / Water Management

Mihailo Burić (MNE)
Hydrology / Water Management
Task & Deliverables Logistics and Progress

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
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 hydropower 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

BR-1 'On the Role of Hydropower in the Past and Prospects in the Future by 2030/2050'
BR-2 'On Gap Analysis of the Legal-Regul. and Instit.-Organ.-Framework Rel. for Hydropower Dev.'
BR-3 'On Baseline Data on Hydrology and Water Management Issues'
BR-4 'On Transboundary Issues in the WB6 Region'
BR-5 'On Grid Connection Issues Related to Prospective HPP projects'
BR-6 'On Inventory of Rehabilitation and Prospective HPP Projects, GIS and IDMS'
BR-7 'On Environmental Analysis'
BR-8 'On Multi-Criteria Assessment of HPP Projects – Portfolio of HPP Investments'
BR-9 'On Regional Action Plan on the Hydropower Development'

MC-SP1: Strategy paper to Ministerial Council WB6 'On Transboundary Issues''
MC-SP3: Strategy paper to Ministerial Council WB6 'On Priority Investment Projects (rehabilitations and greenfield HPP projects)''

Completed
Great progress
Medium progress
Less progress
Progress and tangible results (from 1 October 2016 to end February 2017) by Task structured around (9) Background Reports (BR)
### BR-1 Past and Future Role of HPPs in WB6

#### Existing HPPs (as of 31.12.2017)

<table>
<thead>
<tr>
<th>Country</th>
<th>&gt;10MW</th>
<th>(&lt;10MW</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALB</td>
<td>15</td>
<td>137</td>
<td>152</td>
</tr>
<tr>
<td>BIH</td>
<td>16</td>
<td>66</td>
<td>82</td>
</tr>
<tr>
<td>MKD</td>
<td>9</td>
<td>75</td>
<td>84</td>
</tr>
<tr>
<td>KOS</td>
<td>1</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>MNE</td>
<td>2</td>
<td>16</td>
<td>18</td>
</tr>
<tr>
<td>SER</td>
<td>12</td>
<td>19</td>
<td>31</td>
</tr>
<tr>
<td>WB6</td>
<td>55</td>
<td>321</td>
<td>376</td>
</tr>
</tbody>
</table>

**Share**

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### Installed capacities in hydro power plants (MW, %)

<table>
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<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALB</td>
<td>1.571</td>
<td>252</td>
<td>1.824</td>
</tr>
<tr>
<td>BIH</td>
<td>2.081</td>
<td>102</td>
<td>2.183</td>
</tr>
<tr>
<td>MKD</td>
<td>574</td>
<td>97</td>
<td>671</td>
</tr>
<tr>
<td>KOS</td>
<td>35</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td>MNE</td>
<td>649</td>
<td>25</td>
<td>674</td>
</tr>
<tr>
<td>SER</td>
<td>3.092</td>
<td>31</td>
<td>3.123</td>
</tr>
<tr>
<td>WB6</td>
<td>8.001</td>
<td>549</td>
<td>8.550</td>
</tr>
</tbody>
</table>

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### Electricity generation in hydro power plants, 2001-2015 (GWh, %)

<table>
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<th>(&lt;10MW</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALB</td>
<td>4.683</td>
<td>182</td>
<td>4.865</td>
</tr>
<tr>
<td>BIH</td>
<td>5.572</td>
<td>97</td>
<td>5.669</td>
</tr>
<tr>
<td>MKD</td>
<td>1.273</td>
<td>194</td>
<td>1.468</td>
</tr>
<tr>
<td>KOS</td>
<td>91</td>
<td>36</td>
<td>127</td>
</tr>
<tr>
<td>MNE</td>
<td>1.722</td>
<td>33</td>
<td>1.755</td>
</tr>
<tr>
<td>SER</td>
<td>10.549</td>
<td>62</td>
<td>10.611</td>
</tr>
<tr>
<td>WB6</td>
<td>23.891</td>
<td>603</td>
<td>24.495</td>
</tr>
</tbody>
</table>

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<table>
<thead>
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<td>23.891</td>
<td>603</td>
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</tr>
</tbody>
</table>
Average HPP-capacity addition achieved during 1955-1990 was **202 MW** per annum while in the period 1990-2015 it dropped to mere **31 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.

### Period MW % MW/a

<table>
<thead>
<tr>
<th>Period</th>
<th>MW</th>
<th>%</th>
<th>MW/a</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before 1955</td>
<td>667</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td>During 1955-1990</td>
<td>7,081</td>
<td>82,8</td>
<td>202,3</td>
</tr>
<tr>
<td>During 1991-2016</td>
<td>802</td>
<td>9,4</td>
<td>30,8</td>
</tr>
<tr>
<td>Total</td>
<td>8,550</td>
<td>100,0</td>
<td></td>
</tr>
</tbody>
</table>
BR-1 Past and Future Role of HPPs in WB6

Electricity demand forecast in WB6 by 2050
# BR-2 L&R and I&O Framework and Gap Analysis

IOLR Diagrams for all 6 jurisdictions developed (+RS in BiH)

- **Unified methodology** applied
- **Comparative analysis**: aspects of location & construction permits, concession & water resources, grid connection, environmental permitting
- **Development process divided** into: prefeasibility, development & design, construction, trial & operation

<table>
<thead>
<tr>
<th>MKD</th>
<th>SER</th>
<th>ALB</th>
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<th>MNE</th>
<th>BiH-RS</th>
<th>BiH-FBiH</th>
</tr>
</thead>
</table>

- [Image with IOLR Diagrams for MKD, SER, ALB, KOS, MNE, BiH-RS, BiH-FBiH]
BR-3 Baseline Hydrology and Water Management

River Basin Classification applied in the Study
BR-3 Baseline Hydrology

Classification of hydrographic elements:

(4) drainage basins,
(13) watersheds,
(17) river basins,
(10) (sub)river basins,
(26) rivers,
(77) tributaries 1, and
(25) tributaries 2.
1. Drini i Bardhe/White Drin/Beli Drim River System - HPP Zhur (KOS-ALB)
2. Trebišnjica Hydropower Scheme – HPP Dubrovnik 2 (CRO-BIH-MNE)
3. Vardar River System - HPP Lukovo Pole (ALB-MKD-GRE)
4. HPP Buk Bijela (BIH-MNE-SER)
5. Drina River Basin - HPP Koštanjica (MNE-BIH-SER)
6. Čehotina River Basin - HPP Chain on the Čehotina River (MNE-BIH)
7. Drina River System - HPPs along Middle Drina River (SER–BIH)
8. Drini River System - HPP Skavica (ALB-KMD)
9. Vjosa River Basin - HPP Chain on Vjosa River (GRE-ALB)
BR-4 Transboundary Issues

(2) Platforms

- Legal platform for resolving transboundary issues within Energy Community action, administered by the Energy Community Secretariat. **European Commission shall join forces with the Energy Community Secretariat and make a compelling offer to the countries and territories involved.**

- Transboundary issues in hydropower have two platforms, on the basis of which it resolving is possible:
  
  1. under the above-proposed mediation of Energy Community,
  2. another platform is a legal act which provides regulation in a planning phase - Water Framework Directive (WFD).
Until present, transboundary issues in WB6 Region were predominately dealt with water quality aspects and to some extent biodiversity, while hydropower sector and power potential development remained behind any useful baseline.

The greatest negligence is noticed in sharing hydropower potential, so transboundary cases remained where they were or at best went to worse by sizing down of best reservoir locations (like Buk Bijela or Skavica).
BR-5 Grid Connections Issues
Transmission Network

- Transmission network capacities and facilities will never be a constraint for HPP projects.
- All new HPP projects connected to the transmission network:
  - increase overall stability of the regional power system operations,
  - improve power system control capacities, and
  - increase opportunities for integration of other RES generation facilities, such as wind and solar generation.
BR-5 Grid Connections Issues
Distribution Network

- Capacity of the distribution networks in the region is insufficient to facilitate growing demand for connection of small HPPs
- Additional burden for already weak networks is from other RES and distributed generation facilities in general
- Distribution operators are in the unbundling process following opening of the retail market in the region
- Distribution networks require significant reinforcements in:
  - Network facilities
  - Control facilities,
  - Human resources
- Distribution Codes are getting improved, but still far away from transmission
- Certain differences across the region, but connection costs are almost by default paid by the Investor, including necessary network reinforcements
Data collected on **HPP projects over 10MW**, on the following:
- general,
- technical,
- environmental & social,
- hydrology & water management,
- economic & financial,
- maturity

**Total 480 projects** over 10 MW identified. 154 eliminated due to: i) insufficient data, ii) alternative projects

**Total 326 projects** selected for further analysis („Screening“), of which in ALB (232), BIH (37) MNE (17), MKD (17), KOS (3) and SER (21)
This project is funded by the European Union
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.
BR-7 Environmental Analysis
Conducted Activities

• Analysis of national SEA/EIA legal procedures / practices in WB6 countries,

• Description of protected areas,

• Baseline description of important features of chosen (25) river basins,

• GIS data collected for environmental analysis: protected areas, Corine landcover, settlements, riverbasins,

• Fish fauna inventory and residual flow legislation analysis, GIS layers with species distribution.

Spatial analysis – map example
List of threatened species was prepared (41 species) – key species for the study:

- by drainage basins (DB):
  - Black Sea (10 species),
  - Adriatic Sea (29 species),
  - Ionian Sea (2 species),
  - Aegean Sea (6 species).

Problem: WB6 region is ichthiologically insufficiently investigated.
BR-8 Multi-Criterial Assessment (MCA) of greenfield HPP projects

Assessment Approach and Methodology (3-step, each next step more detailed and data intensive)

Step 1: Screening
1 indicator Maturity
HPP candidates identified in Task 6

Step 2: MCA Level 1
4 key indicators Mat, Env, Tech, Econ
“Short listed” HPP candidates
HPP candidates for further development

Step 3: MCA Level 2
50+ indicators Tech, Env, Soc, Econ, Mat
Outstanding HPP candidates
Less recommended HPP candidates

Outcome: HPP candidates ranked into groups
BR-9 Action Plan

**Its characteristics:**

- A concise document on max. 20 pages
- Summarizing main conclusions and recommendations from all BRs (i.e. BR-1 to BR-8)
- Providing concrete proposals for follow-up actions at both (i) horizontal - regonal (WB6) level as well as (ii) by individual WB6-country
- To be prepared as the last BR in the Study (by end-April'17)

**Last steps in the Study:**

- Based on completed (9) BRs, draft Final Report will be prepared (by end-May’17)
- Draft Final report will be presented to all (6) beneficiary countries during a tour to WB6-countries scheduled for 3 weeks (2 countries per week) during 12-30 June 2017
- Based on comments and feedback during the tour, Final Draft of the Final Report will be prepared by August 2017
WBIF-IPF 3 Consortium

Thank you for your attention!

www.wbif.eu