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REGIONAL STRATEGY FOR SUSTAINABLE HYDROPOWER IN THE WESTERN BALKANS

On Grid Connection Issues Related with Prospective HPP Projects

(Presentation of Background Report No. 5)

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1st Workshop, Podgorica, 30-31 March 2017

Table of Contents

- Objectives of the BR-5
- Contents of the BR-5
- Methodology
- Results / Findings – Grid Connection issues
- Results / Findings – Grid Absorption capability
- Conclusions / Recommendations
- Main messages
- Action Items

Objectives of the BR-5

1. Study framework for connection of hydro power plants (HPPs) to transmission and distribution networks in WB6 countries, concerning:
 - Connection rules,
 - Connection procedure,
 - Technical requirements, and
 - Connection costs.

2. Investigate capability of the transmission and distribution networks in WB6 countries to integrate planned HPPs, i.e.:
 - Capacity of the existing networks towards planned HPPs,
 - Synchronization between generation and network planning,
 - Impacts of HPP integration to electrical networks and other users.

Contents of the Background Report

- Introduction – objectives, approach, methodology
 - Grid Access and Grid Connection regulation and practice (Regional and Country-by-country)
 - Capability of the existing grids to facilitate integration of planned HPPs (Regional and Country-by-country)
 - Conclusions and Recommendations
 - Action items
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- BR-5 provides inputs for BR-2
 - BR-5 elaborates connection of BR-6 outputs (HPPs)
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# Methodology applied for development of the Background Report (1)

- Network Connections rules and practices:
  - Studying legislative and regulatory documents (electricity acts, network codes, connection rules, charging methodologies,...)
  - Interviews with line Ministries, Regulators and network operators
  - Meetings with HPP Developers and case studies
- HPP integration capacity:
  - Studying current status of transmission and distribution networks in WB6
  - Preliminary assessment - comparing network development plans with planned new HPP capacities from energy strategies, NREAPs and IGDPs
  - Interviews with planning and operations experts from network operators
  - Final assessment – analysis of the network capacity to facilitate HPPs from the BR-6 output (to be completed)

## Methodology applied for development of the Background Report (2)

- General approach applied in this BR-5 is:
  - Large HPPs (generation units with the installed capacity  $>10$  MW ) are mainly connected to the transmission network
  - Small HPPs (generation units with the installed capacity  $\leq 10$  MW) are mainly connected to the distribution network
- Exemptions from the general rules may apply because:
  - Asset boundary between transmission and distribution differs among regional countries
  - Feasibility of network connection may limit options
  - Technical conditions for connection and/or connection costs may prevail to other network

# Transmission Grid Connection - Summary

|                                        | ALB                                                                       | BiH                                                                       | MKD                                                                 | MNE                                                                                                            | KOS                                                         | SER                                                         | Comments |
|----------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------------------------------------------------------|----------|
| Electricity/Energy Law articles on DSO | 2015, harmonised with 3 <sup>rd</sup> Energy Package                      | 2004, NOT in line with 3 <sup>rd</sup> EU Energy Package, new draft ready | 2011, amended and harmonised with 3 <sup>rd</sup> EU Energy Package | End 2015, fully harmonised with 3 <sup>rd</sup> EU Energy Package                                              | Mid 2015, harmonised with 3 <sup>rd</sup> EU Energy Package | End 2014, harmonised with 3 <sup>rd</sup> EU Energy Package |          |
| Transmission Code (TC)                 | 2008, needs update                                                        | End 2016                                                                  | End 2015, very comprehensive                                        | 2011, needs update                                                                                             | February 2015                                               | October 2015                                                |          |
| Connection Rules                       | From the Code                                                             | From 2008, new draft in the procedure                                     | In the Transmission Code                                            | Partly in Law, partly in TC                                                                                    | 2015, Connection Code (KOSTT)                               | 2015, Connection Procedure (EMS)                            |          |
| TSO's right to refuse connection       | NO                                                                        | YES                                                                       | YES, with justification                                             | NO                                                                                                             | NO                                                          | NO                                                          |          |
| Connection costs methodology           | Guidelines by OST from 2010                                               | Transmission Company Rulebook approved by DERK                            | Annex 7 of the TC                                                   | CGES 2016, in the approval procedure                                                                           | Connection charging Methodology, KOST T October 2013        | AERS (Regulator) December 2015                              |          |
| Connection payment principle           | Shallow connection costs in legislation, Deep Connection costs in reality | Shallow connection costs                                                  | Realistic connection costs                                          | If investor constructs and transfers connection assets to TSO, connection costs are Shallow. If not, are Deep. | Realistic connection costs                                  | Realistic connection costs                                  |          |
| Ownership transfer                     | Voluntary, with compensation                                              | Mandatory                                                                 | Mandatory                                                           |                                                                                                                | Mandatory                                                   | Mandatory                                                   |          |
| Use-Of-System charges                  | Consumers only                                                            | Consumers only                                                            | Consumers only                                                      | Consumers only                                                                                                 | Consumers and Generators                                    | Consumers only                                              |          |

<sup>[1]</sup>Shallow connection costs are only costs of the connection infrastructure on its side of the connection point.

<sup>[2]</sup>Deep connection costs are all costs of the connection infrastructure, including costs of the necessary network reinforcements.

## Connection of new HPPs to the Transmission Grid

- Only Network Operators in BiH and MKD are entitled to reject connection applications due to the lack of technical capacities
- Primary legislation up-to-date and harmonised with EU 3<sup>rd</sup> Energy Package (except in BiH where adoption of the new law is still pending)
- Secondary legislation is harmonised towards new electricity laws (except in ALB and MNE where updates of the network codes are still pending)
- Connection procedures defined either in the Grid Codes or in a separate rulebooks (in majority of cases not very clear and not detailed enough)
- Connection charging methodologies approved by the Regulators
- Connection costs are SHALLOW by regulation, but DEEP in practice
- **There were no network connections executed under the new framework**



## Distribution Grid Connection – Summary

|                                        | ALB                                                      | BiH                                                                       | MKD                                                     | MNE                                                               | KOS                                                     | SER                                                         | Comments |
|----------------------------------------|----------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------------|---------------------------------------------------------|-------------------------------------------------------------|----------|
| Electricity/Energy Law articles on DSO | 2015, harmonised with 3 <sup>rd</sup> EU Energy Package  | 2004, NOT in line with 3 <sup>rd</sup> EU Energy Package, new draft ready | 2015, harmonised with 3 <sup>rd</sup> EU Energy Package | End 2015, fully harmonised with 3 <sup>rd</sup> EU Energy Package | 2015, harmonised with 3 <sup>rd</sup> EU Energy Package | End 2014, harmonised with 3 <sup>rd</sup> EU Energy Package |          |
| Distribution Code (DC)                 | 2003, needs update                                       | 2008/2009, new version in procedure                                       | 2012/2014 very comprehensive                            | 2012, EPCG, needs update                                          | 2014, KEDS                                              | 2009, amendments 2013,2014 and 2015                         |          |
| Connection Rules                       | Partly available in the DC                               | 2008 (FBiH in DC) 2014 (RS, separate from DC)                             | Part of the DC                                          | 2012, EPCG                                                        | Inside the DC                                           | Amendments to the Distribution Code from 2014               |          |
| DSO's right to refuse connection       | NO                                                       | YES                                                                       | YES, with justification                                 | NO                                                                | NO                                                      | NO                                                          |          |
| Connection costs methodology           | None                                                     | Methodology by entity Regulators                                          | Annex 1 of the DC                                       | Not available                                                     | 2005, KEK                                               | AERS (Regulator) December 2015                              |          |
| Connection payment principle           | Shallow connection costs in legislation, deep in reality | Between Shallow and Deep connection costs                                 | Between Shallow and Deep connection costs               | Not available                                                     | Realistic connection costs                              | Deep connection costs                                       |          |
| Ownership transfer                     | Voluntary, with compensation                             | Voluntary                                                                 | Voluntary                                               | Not available                                                     | Mandatory                                               | Mandatory                                                   |          |

<sup>[1]</sup>Investor participates partly in the costs of the distribution network reinforcement for facilitation of the requested connection. Share is defined on a case-by-case basis at early stage of the project development.

<sup>[2]</sup>Investors which do not transfer ownership of the connection infrastructure to the DSO are obliged to maintain it.

<sup>[3]</sup>Same as above.

## Connection of new HPPs to the Distribution Grid

- Secondary legislation is not fully harmonised towards new electricity laws (especially in ALB, BiH and MNE where network codes are rather old)
- Connection procedures are defined either in the Grid Codes or in a separate rulebooks, but not sufficiently detailed and clear
- Connection charging methodologies are very clear in SER and MKD, less developed in KOS and BiH, and pending in MNE and ALB
- Connection costs are SHALLOW by regulation, but DEEP in practice
- EVN Macedonia introduced **one-stop-shop** for construction permits for connection infrastructure
- Negotiated connections still exist in practice
- Asset transfer after connection to the network remains an issue

## Grid Connection – Recommendations

- Transmission Network
  - Pending documents should be developed; sections on HPP connections should be updated and/or elaborated in more detailed
  - Existing documents should be fully harmonised vertically and horizontally
  - Connection costs should be fair, transparent and predictable
  - Transfer of assets should not be mandatory
- Distribution Network
  - Grid Codes should be updated and harmonised with electricity laws
  - Connection procedures and technical requirements for connections should be further developed and harmonised
  - Connection pricing should be known at early stage of the project development

## Grid Absorption capability – Transmission Network

- Transmission grid operators have always been focused on grid related issues only; Since early 1990's, main driver for Transmission Grid development was interconnectivity (trading), not generation development
- Due to significant transmission network developments, main backbone seems to be **capable to facilitate all existing and planned HPPs** (some reinforcement may be necessary in the vicinity of the plants)
- For various reasons **transmission network capacities and facilities should never be regarded a major constraint for HPP development projects**
- New HPPs connected to the transmission network:
  - **Improve the overall stability** of regional power system operations,
  - **Increase power system control capacities**, and
  - **Enhance conditions for integration of other generation facilities** using renewable energy sources, such as wind and solar generation.

## Transmission Grid Capacity vs. new HPP development

|     | New Transmission Lines*                                                               | Planned Transmission Lines                                                                                         | New HPPs (MW)                |
|-----|---------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|------------------------------|
| ALB | 400kV Podgorica (MNE)-Tirana-Elbasan<br>400kV Tirana-Pristina (KOS)                   | 400kV Elbasan-Bitola (MKD)<br>400kV Elbasan-Fier                                                                   | Ashta (53)                   |
| BiH | 400kV Ugljevik-S.Mitrovica (SER)                                                      | 400kV Banjaluka-Lika (CRO)                                                                                         | None                         |
| KOS | 400kV Tirana (ALB)-Pristina                                                           |                                                                                                                    | None                         |
| MKD | 400kV Štip-Červena Mogila (BUL)<br>400kV Štip-Niš (SER)<br>400kV Bitola-Amindeo (GRE) | 400kV Elbasan (ALB)-Bitola                                                                                         | Kozjak (70)<br>Sv.Petka (25) |
| MNE | 400kV Podgorica –Tirana (ALB)                                                         | 400kV Lastva-Pljevlja-SER<br>(u.c.)                                                                                | None                         |
| SER | 400kV Ugljevik (BiH)-S.Mitrovica<br>400kV Štip (MKD)-Niš                              | TransBalkan corridor to MNE<br>Upgrade of the internal 220kV grid to 400kV<br>400kV Resita (ROM)-Pančevo<br>(u.c.) | None                         |

## Grid Absorption capability – Distribution networks

- Distribution networks in WB6 are under unbundling process. Before unbundling their focus was on collection, not on grid service. Now, focus is moving towards network issues (reliability, quality) and network development for new connections (coincides with RES development)
- **Capacity of the distribution networks in the region is insufficient to facilitate growing demand for connection of small HPPs**
- Additional burden for already weak distribution networks is from other RES and distributed generation facilities in general
- **Distribution networks require significant reinforcements** in:
  - Network assets (lines, switchgears, transformers, protection,...),
  - Metering, telecommunication and control facilities,
  - Staffing, especially in planning and operations

# Long-Term Network Development Planning

(1)

## Transmission:

- In the regional transmission networks TNDP is regular activity
- Quality of 10-Year TNDP differs through the WB6 region – full framework (regular cycle: development-update-approval) exists only in BiH

## Distribution:

- In the regional distribution networks there are no regular long term DNDP activities
- Existing short/mid term distribution network development planning does not include facilitation of new generation – it is an “ad-hoc” activity

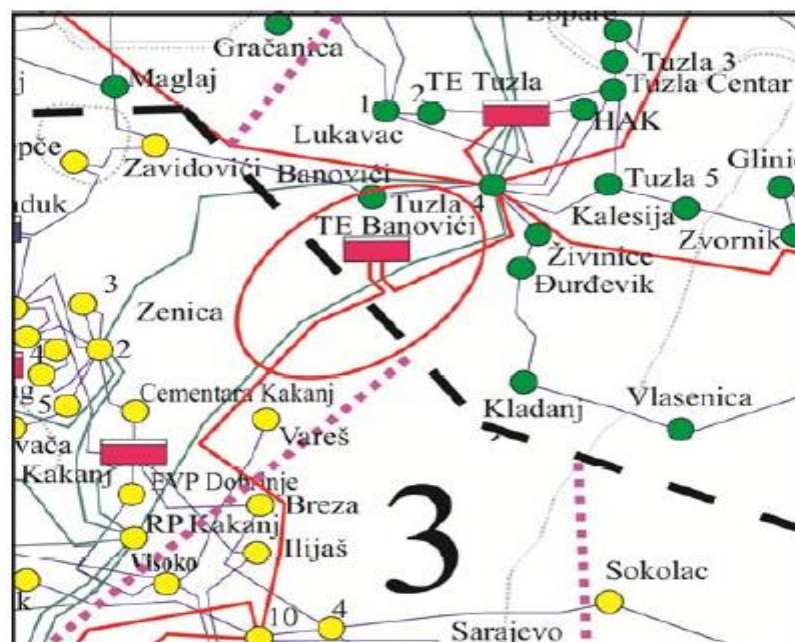
# Long-Term Network Development Planning

(2)

## 8.1.6.8. TE Banovići

TE Banovići, instalisane snage 1x350 MW (350 MW), godišnje proizvodnje 2252,3 GWh, investitora RMU „Banovići“ d.d. Banovići, prema L[11], priključuje se na prenosnu mrežu po principu ulaz/izlaz na DV 400 kV Sarajevo 10 – Tuzla 4. Prema izdatim Uslovima za priključak na prenosnu mrežu priključenje ove elektrane je planirano 2019. godine, a u IPRP ova elektrana je bilansno uključena u 2020. godini.

Način priključenja TE Banovići u EES BiH prikazan je na Slici 8.8.



Slika 8.8. Priključenje TE Banovići u EES BiH



## Grid Absorption capability – Recommendations

- Maintain and, where applicable, improve 10-Year TNDP frameworks in WB6 countries, including 3-year investment planning, regular updates and approvals by the national Regulators
- Introduce cycle of 10-Year DNDP frameworks using model of the TNDP
- Invest in development of new and refurbishment of existing distribution network facilities in all WB6 countries
- Improve metering, telecommunication and control facilities in distribution networks
- Provide necessary expertise in DSOs (additional staff, capacity building, training)

## Main messages

- Transmission network (connection/absorption of large and medium HPPs) is not an issue, activity focus should be on distribution network
- **Create and maintain sustainable framework** for connection and integration of new hydropower generation into distribution networks, i.e.:
  - Introduce/apply **feasible** legal/regulatory requirements
  - **Balance requirements** for network operators with their actual capacities
  - Establish **long-term network development planning** framework
  - Provide necessary funding for **distribution network technical and operational upgrading**
  - Support **capacity building** of the DSOs

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