Status of Hydropower in Serbia

Prof. Dr. Milos Nedeljkovic

University of Belgrade
Faculty of Mechanical Engineering
Department for Hydraulic Machinery and Energy Systems

Outline

- Status of main energy resources
- Status of main HPS
- Status of Pump-Turbine HPS
- Status of small HPS
- Feed-in tariffs
- Possibilities

Status of all energy resources

- Thermal power = 5,171 MW
  - TPPs Nikola Tesla A and B
  - TPPs Kostolac A and B
  - TPPs Kolubara and Morava

- Hydro power = 2,835 MW
  - HPSs Djerdap 1 and 2, plus …
  - HPSs Bajina Bashta, plus …

Status of all hydro power capacities

"Electric Power Industry of Serbia" has 16 HPSs with total power of 2,835 MW

System of HPSs "Djerdap"

(Djerdap 1, Djerdap 2, Pirot, Vlasinske)

1,537 MW

7,365 GWh per year

18% of total thermal and hydro

67% of total hydro

Status of all hydro power capacities

System of HPSs "Drinsko-Limske"

(Bajina Bashta, RHE Bajina Bashta, Uvac, Kokin Brod, Bistrica, Potpec, Zvornik)

1,294 MW

3,656 GWh per year

15.5% of total thermal and hydro

33% of total hydro

Status of all hydro power capacities

System of HPSs “Elektromorava”

(Ovcar Banja, Medjuvrshje)

13 MW

Status of all hydro power capacities

River Danube, Serbian part

HPS Djerdap 1, Total 1058 MW

6 units, 178 MW each

HPS Djerdap 2, Total 270 MW

10 units, 27MW each

Status of all hydro power capacities

HPS Pirot, Total 80 MW

2 units, 40 MW each

System Vlasina, 10 units, 129 MW,

285 GWh per year

HPSs Vrla 1, 2, 3 and 4

PumpSS Lisina

Status of all hydro power capacities

HPS Bajina Bashta, Total 364 MW

4 units, 91 MW each

1,819 GWh per year

HPS RHE Bajina Bashta (Reversible PT)

2 units, 307 MW each

Total 614 MW (pump mode 620MW)

800-1,000 GWh per year

Status of power production

Data per year

- Total approx. 35,000 GWh
- Total thermal power approx. 24,000 GWh
- Total hydro power approx. 11,000 GWh

Status of hydropower potential

Data per year

- Total potential estimated to 18,000 GWh
- Total used estimated to 11,000 GWh

- Unused potential of 5200 GWh mostly on rivers Morava, Drina, Lim and Danube predicted for big HPSs (>10 MW)
- The rest of 1800 GWh on other smaller rivers predicted for small HPSs (<10 MW)

Current situation

Big HPSs

Revitalisations finished:

- HE Ovchar Banja and HE Medjuvrshje (finances EPS)
- HE Bajina Bashta (finances EPS and KfW)

Revitalisations in progress:

- HE Djerdap 1 (finances EPS and Russian debt)
- HE Zvornik (finances KfW)

Current situation

Big HPSs (continued)

Revitalisations planned:

- Vlasinske HE
- HE Bistrica
- HE Potpec
- RHE Bajina Bashta (reversible pump-turbine)

Current situation

New capacities (design project phase)**:**

- HE Ibarske
- HE Moravske
- HE Srednja Drina
- RHE Djerdap 3 (reversible pump-turbine)
  2400 MW, 5,500 MEUR, RWE-Innogy
- RHE Bistrica (reversible pump-turbine) = 680 MW
  4 units, 170 MW each, 600 MEUR

Additional units:

- HE Potpec, 4th unit
- HE Bajina Bashta 5th unit

Current on-going situation

River Drina

- Near Ljubovija – 2 HPSs = 300 MW, plus 12 small around
- MidDrina – 3 HPSs = 320 MW, EPS+Secci, 800MEUR
- UpperDrina – 4 HPSs = 238 MW, EPS+RWE interest ??

River Lim

- Brodarevo – 2 HPSs = 56 MW, REV (Canada), 140MEUR

River Velika Morava

- 5 HPSs – 150 MW, EPS+RWE-Innogy, 352MEUR

Current on-going situation

River Ibar
- 10 HPSs – 103 MW, EPS+Secci, 285MEUR

Plans for HPSs (long run):
- Ribarici
- RHE Ribarici (reversible)
- Vrutci
- Svodje
- Pakleshtica
- Arilje

Cadastre of small HPSs

- Since 1987, but officially since Nov.2014 856 locations for small HPS with all relevant data publicly available on web site of the Ministry for Energy
- Tenders for locations published and a lot of documentation for small HPSs in progress and finished, but not a single small HPS built and in operation

Current situation

Small HPSs:

- documentation finished:

1. technical and for investment
2. feasibility studies
3. environmental impact assessment studies
4. master (space and urbanistic) plans
5. and finished pre actions needed considering opinions, conditions, approvals and permits.

for:

- 8 small HPSs defined and already in tender
- 8 small HPSs in accumulations for water supply systems
- 15 small HPSs owned by “Electric Power Industry of Serbia”

Feed-in tariffs

Small HPSs:

Power MW - P	Price EURcent/kWh
< 0.2	12.40
0.2 – 0.5	13.727-6.633*P
0.5 – 1	10.41
1 – 10	10.747-0.337*P
10 – 30	7.38
10 – 30 on existing infrastr.	5.90

Selling prices of EPS

Tax of 20% inclusive

Inhabitants (living houses, homes)	Single tariff measur. device EURcent /kWh	Higher tariff EURcent /kWh	Lower tariff EURcent /kWh	UTD	Available power tax EURcent /kWh	El.en. Supplier costs
GREEN <350kWh	4.04 (4.924)	(5.628)	(1.407)		(45.883)	(125.530)
BLUE 351-1600	6.05 (7.386)	(8.440)	(2.110)			
RED >1600kWh	12.11 (14.772)	(16.880)	(4.220)			

Legislation

Documents needed (24 of them):

1. Copy of location from master (urbanistic) plan or legal act on urban conditions
2. Legal act on purpose of land with conditions defined in respect to measures and conditions for environmental protection
3. Positive opinion of public company “Serbia water resources” (Srbijavode)
4. Positive opinion of public company “Electric Power Industry of Serbia” on electrical and energy conditions

Legislation

5. Positive opinion of “National hydro-meteorology institution”
6. Positive opinion of regional water resources company
7. Positive decision on water resources use conditions from the Ministry of Agriculture and water resources
8. Positive decision of the municipality of building up of the small HPS
9. License on energy production and connection to the electric energy grid
10. License for qualified acting in energy production activities

Legislation

11. Study on impact of small HPS building-up on environmental protection with previously defined conditions for nature and environment protection implemented
12. Positive opinion of the Ministry on the previous Study
13. Design project on the level of idea-solution.
14. Design project on the level main project (for execution)
15. Positive opinion of “Electric Power Industry of Serbia” on electrical part of the project.
16. Positive opinion of police fire protection department on the design documentation

Legislation

17. Conditions for cutting of green bushes and trees for the terrain preparation
18. Permission for works on building-up.
19. Start of works check-in.
20. Documentation of the final design status of completely built object and technical inspection pass.
21. Permission for work with water resources.
22. Permission for the use of the HPS.
23. Confirmation on having the special privileged status of the object.
24. Agreement on conditions of electric energy sale.

Correspondence

University of Belgrade
Faculty of Mechanical Engineering
Department of Hydraulic Machines and Energy Systems
Kraljice Marije 16
11120 Belgrade 35
Serbia

- Milos Nedeljkovic: mnedeljkovic@mas.bg.ac.rs

Thank you for your attention !