The significance of hydropower for the Balkan region and Europe

Udo BACHHIESL[1(1)], Robert GAUGL[(1)]
[(1)] Graz University of Technology/Institute of Electricity Economics and Energy Innovation

Motivation and research question

In order to battle against the ongoing climate change and to reduce the import dependency of fossil fuels – especially in the European Union (EU) – the intensified use of renewable energies will play an eminent role in the future energy economy. At the moment the way for the transition of the European energy system is in an intensive discussion phase, whereupon there are basically manifold options for using renewable energies. The several options of using renewable energies – like in the form of wind energy, hydropower, solar energy, biomass or geothermal energy – show very different characteristics, especially regarding the integration in the energy system from a systemic point of view. Historically, hydropower particularly holds a prominent position in the European electricity system and has already been used very intensively, especially in the alpine region and in the northern part of Europe. The analysis shows, that there are regions with a still notably unused hydropower potential. This contribution focuses on the Balkan region and points out, that there is still a high potential of untapped possible hydropower sites, especially under the consideration of the ongoing process of the extension of the EU in the south-eastern region of Europe.

Methodical approach

This paper presents the actual status and the potential future role of hydropower for the Balkan region as well as for whole Europe. Within this work the Balkan region covers the countries Albania, Bosnia and Herzegovina, Bulgaria, Kosovo, Croatia, Macedonia, Montenegro, Romania, Serbia and Slovenia. The basis for the scenario investigation was a fundamental electricity economic analysis of the above-mentioned countries. The analysis coveres the power plant park, as well as the network infrastructure in this region. A special focus has been set on the situation of hydropower. For every single country, all existing single hydropower plants have been analysed and the still available technical potential has been identified. In order to quantify the future role of hydropower in a comprehensive way, scenarios were built and calculations have been performed based on the gathered data using the electricity economic simulation model ATLANTIS. Two different scenarios have been built, and the second scenario especially focuses on a high utilisation of the still existing hydropower potential in this region until 2040.

Results and conclusion

At the beginning, aside the analysis of the general basic conditions, primarily the present status of hydropower has been identified. Table 1 shows the basic situation for the year 2016 with all the installed hydropower plants divided into large hydropower plants (HPP) and small hydropower plants (SHPP) and especially points out the installed capacities in MW and produced energy in GWh/a.

	Number of Sites			Power [MW]			Energy [GWh/a]		
Country	Total	HPP	SHPP	Total	HPP	SHPP	Total	HPP	SHPP
Albania	80	10	70	1.866	1.576	290	6.113	5.068	1.045
BuH	36	16	20	2.142	2.067	75	6.249	5.996	253
Bulgaria	86	29	57	3.099	2.857	242	4.297	3.466	831
Kosovo	10	1	9	75	35	40	235	88	147
Croatia	27	17	10	2.028	1.993	35	6.292	6.185	107
Macedonia	45	9	36	645	571	74	1.475	1.216	259
Montenegro	20	2	18	697	667	30	1.573	1.491	82
Romania	302	120	182	6.940	6.389	551	19.197	17.472	1.752
Serbia	36	16	20	3.013	2.967	46	11.524	11.359	165
Slovenia	70	21	49	1.219	1.134	85	4.859	4.440	419
Total	712	241	471	21.724	20.256	1.468	61.814	56.781	5.060

Table 1: Up to date status of hydropower in the Balkan region

[1] Inffeldgasse 18, +43 316 873 7903, bachhiesl@tugraz.at, www.IEE.TUGraz.at

The detailed analysis of the still unused technical hydropower potential in the considered region shows a value of over 80 TWh per year. In comparison, the electricity demand in Austria showed a value of approximately 70 TWh in the year 2016. The gathered information regarding the hydropower potential formed the basis for the simulation calculations. Two different scenarios have been defined and scenario 2 is oriented at a preferably full utilisation of the existing hydropower potential in this region. As an example of the simulation results, Figure 1 shows a detailed result for the capacity utilization of the transmission network for Montenegro in 2040 regarding the integration of additional hydropower production in the regional electricity system, under the consideration of the whole European system.

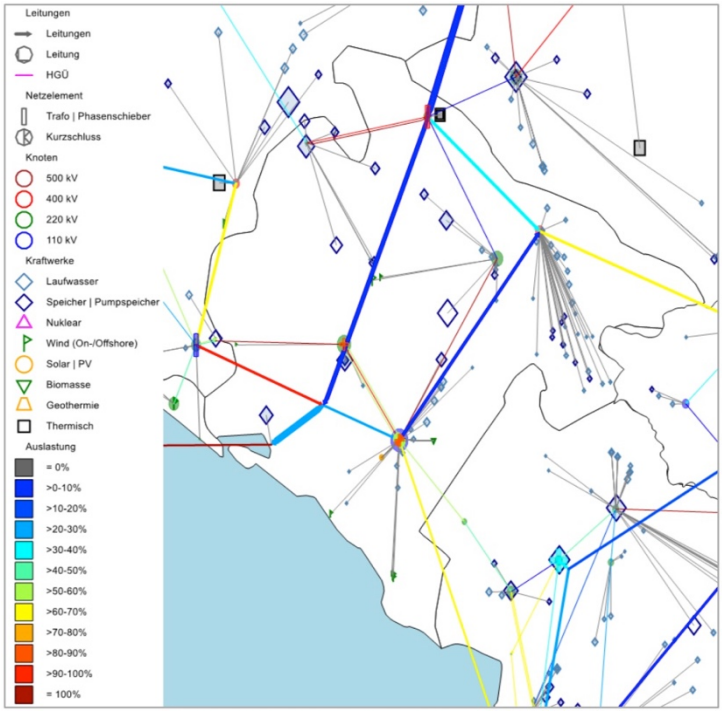

Figure 1: Capacity utilisation of the transmission network in Montenegro, 2040 (Scenario 2)

Aside from several other calculated and investigated parameters, from an economic point of view, the needed investments have also been estimated and are shown for the scenario 2 in Figure 2.

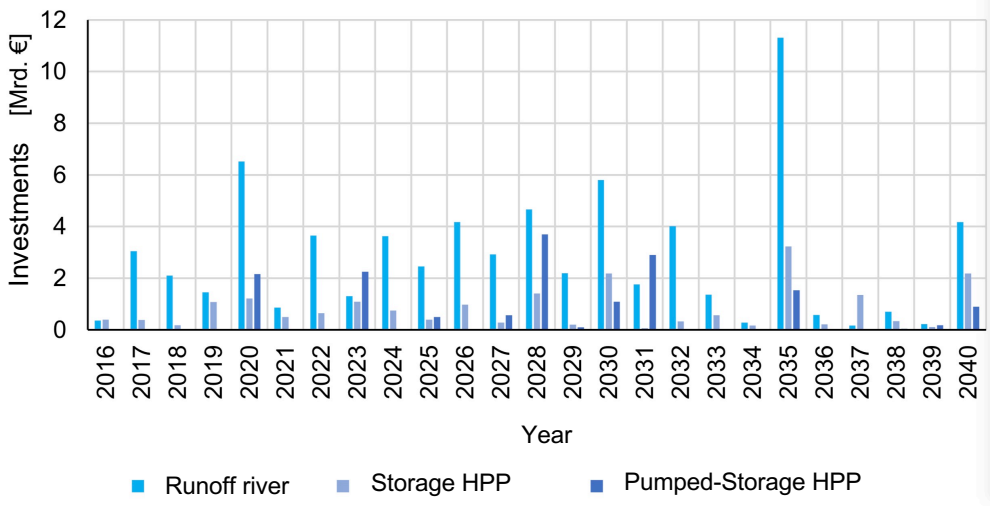

Figure 2: Needed investments for the realisation of the hydropower potential in the Balkan region

Summing up it can be concluded, that due to historic reasons there is still a high untapped hydropower potential in the Balkan region. This work identified, aside from the detailed present state of hydropower in this region, also the additional available hydropower potentials. The system integration has been investigated by scenario calculations using ATLANTIS. The realisation of such a scenario requires a high need of investments in the regarded countries, and it could be part of the extension negotiations of the EU to find a way for the realisation of the identified hydropower potential (e.g. kind of Marshall plan).