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## **The Central Asia Nexus Dialogue Project: Fostering Water, Energy and Food Security Nexus Dialogue and Multi-Sector Investment in Central Asia**



# **Management of transboundary water resources in the Danube and the Sava River Basins**

December 2019

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## Introduction

The European Union project “Central Asia Nexus Dialogue Project: Fostering Water, Energy and Food Security Nexus Dialogue and Multi-Sector Investment in Central Asia” supported the study tour for the delegation from Central Asia to Vienna, Austria, and Zagreb, Croatia, in May 2019 to learn the European experience on the management of the transboundary water resources of Danube and Sava River Basins. The delegation conducted technical meetings with the International Commission for the Protection of the Danube River (ICPDR) and the International Sava River Basin Commission (ISRBC) and paid two site visits in Vienna, Austria, and Zagreb, Croatia, respectively.

This analytical work “Management of transboundary water resources in the Danube and Sava River Basins” conveys knowledge and information on the management of the transboundary water resources by acknowledging the importance of the WEF Nexus in the Danube and Sava River Basins. Firsthand information was received during face-to-face meetings with the ICPDR and the ISRBC and the summarized work at hand shares the European experience with a wider audience.

The analytical work narrates the institutional and legislative frameworks within the sectoral characteristics on the management of two River Basins: the Danube River Basin, which is the largest and the most international one in Europe, and the Sava River Basin, which serves as the greatest tributary to the Danube River. The study reviews the operations of the ICPDR and the ISRBC and technical tools applied at the basin level, which include accident emergency warning systems, monitoring networks, flood forecasting and more.

Although, the Europe faces different water challenges, the legal settings and commitments of the riparian countries matters. As such, Europe does not experience significant water deficits. Unlike Central Asia, the Himalayas and South America, where permafrost glaciers serve as a main water resources provider, Europe has mix regime with rich precipitation, glaciers and arctic permafrost in Switzerland and Scandinavia. Hence, river basin management is not so much focused on the water quantity with any water allocation limits, but looks at the water quality and organic pollution, nutrient and hazardous substances and hydromorphology, as the transboundary water resources serve as a source for drinking water and navigation.

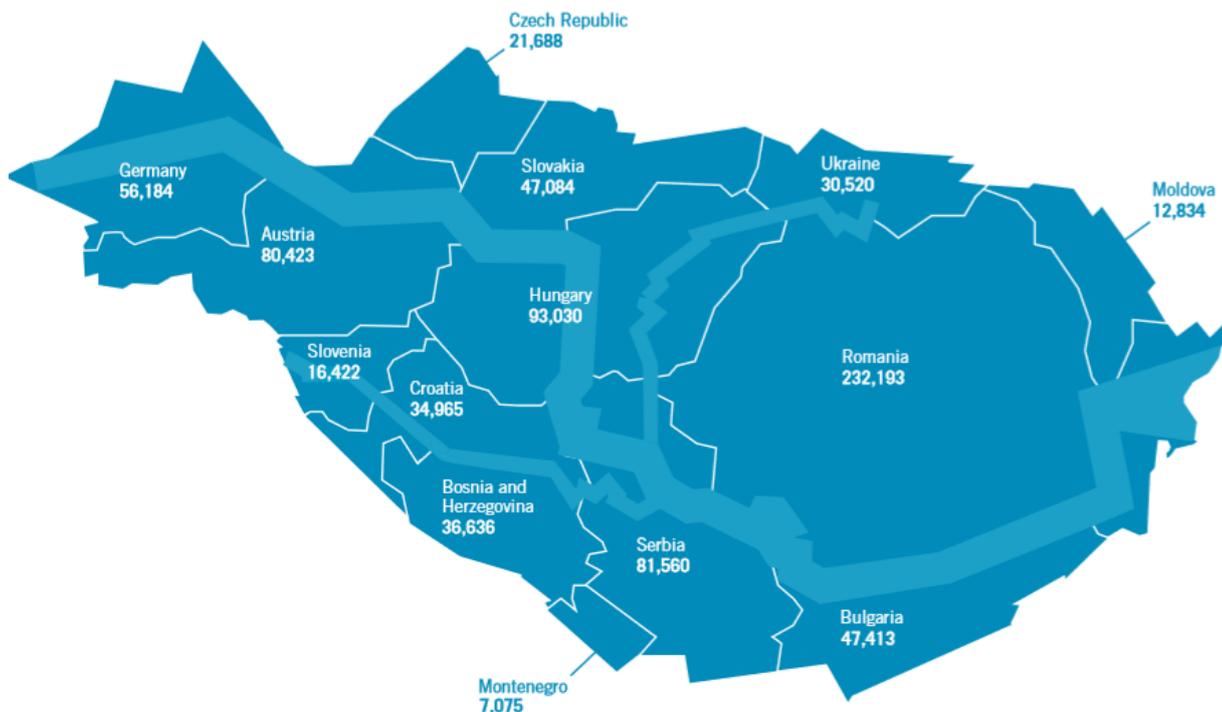
On top of that, the European experience on transboundary cooperation for water issues goes back a long way. For example, the Danube River Basin has over a century of cooperation history, including with the Austro Hungarian and Russian Empire on navigation issues. After the establishment of the Soviet Union cooperation and dialogue between Central and Eastern Europe was interrupted until its collapse. Since 1994, the respective international conventions were signed to resume the transboundary water cooperation between Central and Eastern Europe and have been in practice for the last decades.

## Geography of the Danube and Sava River Basins

The Danube River originates in southwest Germany and extends over 2,857 km through ten countries before it flows into the Black Sea in Romania. The whole Danube River Basin extends into the territories of 19 countries. It is considered the most international river basin in the World. The basin river area is 817,000 km<sup>2</sup> making up 10% of continental Europe. The River Basin is not evenly distributed across riparian countries. 60% of the River Basin belongs to half of the signatory countries. The Danube River is the second largest in Europe after the Volga (3 535 km in length) and divided into the upper (mountainous relief from Germany to Slovakia), medium (the most water-rich part with a large number of tributaries from Bratislava to the border of Serbia and Romania) and the lower basin (lowlands, plateaus and mountains in Romania and Bulgaria, including the 6,750 km<sup>2</sup> Danube Delta).

The Sava River originates in Slovenia and flows through Croatia, along the northern border of Bosnia and Herzegovina, and through Serbia, discharging into the Danube in Belgrade. The Sava River is 992 km long and its basin area encompasses 97,700 km<sup>2</sup>. Over 90% of the River Basin belongs to four countries: Slovenia, Croatia, Bosnia and Herzegovina, Serbia (*Picture 1*). The basin also encompasses parts of Montenegro and a very small part of the catchment area belonging to Albania. The largest share of the basin lays on territory of Bosnia and Herzegovina (~ 40%) and Croatia (~ 25%). The Sava is the main tributary to the Danube (12% of the basin). Other main tributaries of the Danube are the Inn, Morava/March, Drau/Drava, Tysa/Tisza, Iskar Siret and the Prut river (*Graphic 1 and 2 in Annex 1*).

*Picture 1: Map of Danube and Sava Rivers*



Source: *The Danube River Basin, Facts and Figures, the ICPDR*

The Danube and Sava River Basins both have diverse biological and landscape features, ranging from large flatland forests to a largest complex of alluvial wetlands. In the Sava River Basin seven sites are covered by the Ramsar Convention and a number of areas are categorized to have ecological importance and enjoy protection by the state. The Danube River Delta itself is a global, cross-border UNESCO World Heritage Site and the natural reserve “Man and Biosphere”.

## Management of the Danube and Sava River Basins

The collapse of the Soviet Union and Yugoslavia and the retrieval of the independence by the Balkan countries required the development of a new framework document on the management of the transboundary water resources of the Danube River and its main tributary, the Sava River. Thus, the Convention for the Protection and Sustainable Use of the Danube River Basin<sup>1</sup> (abbreviated and further as Danube River Protection Convention) was signed by 14 of the Danube riparian states (comprising of EU member states and non-member states) in 1994 and entered into force in 1998.

While, for Sava River Basin the Framework Agreement on the Sava River Basin (FASRB)<sup>2</sup> was signed by 4 Sava Riparian countries. It was initiated in 2001, entered into force in 2004.

«**Convention for the Protection and Sustainable Use of the Danube River Basin**» - 14 with over 2,000 km<sup>2</sup> water intake in the Danube River Basin became members of the international treaty, including Austria, Bulgaria, Croatia, Czech Republic, Germany, Hungary, the Slovak Republic, Slovenia, Romania and five non-EU member countries: Bosnia and Herzegovina, Moldova, Montenegro, Serbia and Ukraine (Contracting Parties). Apart from 14 ICPDR Contracting Parties, the following countries also cooperate with the ICPDR under the European Water Framework Directive: Italy, Switzerland, Poland, Albania and the Republic of Macedonia.

«**Framework Agreement on the Sava River Basin**» - 4 countries in the Sava River became signatories of the international treaty. They are Slovenia, Croatia, Bosnia and Herzegovina, Serbia (Contracting Parties). Montenegro is not a party to the international treaty, but cooperates on a technical level. The first discussions on transboundary water started back in 1999 from the Stability Pact for South-Eastern Europe and the first meeting of the operationalized ISRBC took place in 2005.

In order to implement these international treaties, the International Commission for the Protection of the Danube River (ICPDR) was established to implement *the Danube River Protection Convention* and the International Sava River Basin Commission (ISRBC) was established to implement FASRB as an implementation bodies with permanent headquarter, charter, regulations and budget. Both international commissions have the status of an international organization. The Seat of the ICPDR is Vienna, Austria. The ISRBC is seated in Zagreb, Croatia.

The development of these international treaties happened on two levels: the high-policy level and the technical level without involvement of third parties. It took no more than a year to develop the draft treaties and reach an agreement on it. At the very beginning, there were different priorities,

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<sup>1</sup> Convention for the Protection and Sustainable Use of the Danube River Basin - <https://www.icpdr.org/>

<sup>2</sup> Sava River Basin the Framework Agreement on the Sava River Basin - <http://www.savacommission.org/>

different legal status and access to European Union support. But at the same time, there was always continued political support, without which it would not have been possible to launch the work of the ICPDR and the ISRBC.

## Legal and institutional structure

The international treaties *Danube River Protection Convention* and the *FASRB* regulate the principles, objectives and institutional framework for the implementation of the international treaties and arbitrage on around twenty pages each. In general, the international treaties call for the equal management of the surface and ground waters and do not entail penalty policy and joint implementation of the transboundary projects, interchangeable use of resources or other economic mechanisms for the use or exchange of resources. The international treaties define only the fundamental principles for transboundary river management recognized and followed by the signatory countries.

*«Water is not commercial product similar to others, but the heritage that we need to preserve, protect and use rationally», - extract from the European Union Water Framework Directive*

All Contracting Parties of the *Danube River Protection Convention* and the *FASRB* bear equal responsibility, regardless of the occupied area of the river basin or its socio-economic well-being (GDP *per capita* of the countries participating in the basins varies from 2,000 to 45,000 US dollars)<sup>3</sup>. For example, a little over 600 meters of the Danube River passes through the territory of Moldova, yet the country has full rights and responsibilities as a party to the international treaty.

### The Commissions' work

**The International Commission on Protection of Danube River (ICPDR)** deals with the issues related to the preservation of the surface and ground waters, control on the emergency situations as a result of natural disasters and flooding and reduction of the surface and underground water pollution, but not navigation issues, which is carried under another commission titled *the Danube Navigation Commission*. The ICPDR Presidency rotates annually among the Contracting Parties of the *Danube River Protection Convention* in alphabetical order. In addition to 14 Contracting Parties, the ICPDR has 24 official observers from other intergovernmental organizations, environmental NGOs and the business sector.<sup>4</sup> The ICPDR meets twice a year with the participation of delegations of participating member-countries and observers. The meetings are chaired by the ICPDR President and take place at the ICPDR headquarter in Vienna, Austria; the

<sup>3</sup> According to the World Bank as of 2017: Austria - US\$47 290; Bosnia and Herzegovina - US\$5148; Bulgaria – US\$ 8 228; Croatia – US\$13 382; Czech Republic – US\$ 20 368; Germany - \$US 44 469; Hungary - \$US 14 224; Moldova - \$US2 289; Montenegro - \$US-7 782; Romania - \$US 10 817; Serbia - \$US 5 900; Republic of Slovakia - \$US17 605; Slovenia - \$US 23 597; Ukraine – US\$ 2 639. Average GDP per capita in EU countries – US\$ 33 723;

<sup>4</sup> Black Sea Commission, Carpathian Convention, Central Dredging Association, Danube Competence Center, Danube Civil Society Forum, Danube Commission, Danube Environmental Forum, Danubeparks, Danube Tourist Commission, European Anglers Alliance, European Barge Union, European Water Association, Friends of Nature International, Global Water Partnership, International Association for Danube Research, International Association of Water Supply Companies in the Danube River Catchment Area, International Hydrological Program of the UNESCO, International Sava River Basin, Commission, RAMSAR Convention on Wetlands, Regional Environmental Center for Central and Eastern Europe, VGB PowerTech e.V., Via donau, World Wide Fund for Nature – Central Eastern Europe, Danube Sturgeon Task Force.

second meeting takes place in the current ICPDR Presidency country. Each participating member-country delegates its representatives and experts. The permanent secretariat of ICPDR has 12 staff. The European Union joined the ICPDR as 15<sup>th</sup> contracting party to the *Danube River Protection Convention*. The ICPDR serves as the coordination platform for this legislation in the Danube River Basin, in particular for the EU Water Framework Directive (2000) and the Floods Directive (2007). Consequently, the regional tools technically supporting the management of the Danube River Basin have been passed to the ICPDR, including: a) emergency warning system that sends out warning messages to the downstream countries; b) a transnational monitoring network of surface and groundwaters of the Danube River Basin carried out through one hundred monitoring points. The EU Water Framework Directive, which served as a basis for the operational documents of both Commissions, calls on the EU countries and its potential country-candidates to achieve «good status» under all surface and underground waters not later than 2027. All Contracting Parties of the ICPDR agreed to implement the EU Water Framework Directive, even if they are not the members of the European Union.

Besides, a Strategy for the Danube region was developed by the European Commission and approved by the European Council, which aims to improve water quality and management of the environmental risks in line with the Danube River Basin Management Plan (Priority Areas #4 and #5)<sup>5</sup>.

In 2016, the Ministerial Declaration of the ICPDR Member Countries on the Danube River Basin proclaimed a commitment to three main objectives of cooperation: “Cleaner Water”, “A Healthier Home” for Aquatic Animals and Plants” and “A Safer Environment” for People To Live Without the Fear of Floods.



*Meeting with the ICPDR (Vienna, Austria). Source: CAREC*

<sup>5</sup> <https://www.danube-region.eu/about/our-targets>

**The International Sava River Basin Commission (ISRBC)** deals with issues related to flooding and warning, navigation and water resource management. The ISRBC consists of 8 representatives from 4 Contracting Parties (two representatives from each country), delegated by their respective governments. Usually, the heads of delegations from signatory countries hold positions at the level of the Deputy Minister. Thus, the Commission leads communication with the governments of the signatory countries on how to support the national governments to implement national priorities across the basin. The ISRBC is headed by the Chairman who is rotated every three years among signatory countries in alphabetical order. The permanent secretariat of the ISRBC has around 9 staff.

The ratification process by the international treaty took around five years. Once operationalized, the ISRBC started the development of the geoinformation system and later on the hydrological system was introduced for the exchange of hydro and meteorological data among other serious developments. Accordingly, an additional data exchange agreement was signed. The ICPDR, the Danube Navigation Commission, various NGOs and two countries, Macedonia and Montenegro act as observers in the ISRBC.

Both ICPDR and ISRBC act as a liaison between different stakeholders. For example, in hydropower generation, the ICPDR has made efforts to integrate the water and energy sectors with the participation of NGOs. In the framework of the Joint Statement for the Development of Inland Navigation and Environmental Protection (*abbreviated Joint Statement*), the ICPDR, the ISRBC and the Danube Commission meet on a regular basis to develop joint statements on improvement of navigation, while maintaining the environment and stimulate the meetings of investors interested in navigation, project owners to exchange the experience and discussion.

*«We provide the platform for cooperation and technically sound dialogue. It is important, in particular when there are infrastructure projects. Instead of political battles, we lead the dialogue», - Ivan Zavadsky, ICPDR Executive Secretary.*

### **Modus operandum of ICPDR and ISRBC**

Analytical research and specialized work are predominantly carried out by permanent and additional expert groups set up within the ICPDR and the ISRBC. There are experts' groups for several areas (*See Table 1*) which consist of at least one national expert from each participating country. Expert groups report to the ICPDR and the ISRBC.

Table 1: Expert groups

ICPDR	ISRBC
<ul style="list-style-type: none"> <li>• Flood Protection</li> <li>• Accident Prevention and Control</li> <li>• Information Management and Geographic Information Systems</li> <li>• Special Strategic Group (ad hoc)</li> <li>• Monitoring and Assessment</li> <li>• Pressures and Measures</li> <li>• River Basin Management</li> <li>• Public Participation</li> </ul>	<ul style="list-style-type: none"> <li>• River Basin Management</li> <li>• Accident Prevention and Control</li> <li>• Navigation</li> <li>• Flood Prevention</li> <li>• Legal Issues</li> <li>• Finance Issues</li> <li>• Hydro-meteorological issues</li> <li>• GIS and RIS</li> </ul>

Following the establishment of the legal and institutional frameworks, the ICPDR and the ISRBC with the support of the European Union carried out assessments of the Danube and Sava River Basins and developed operational documents based on the European Union Water Framework Directive with the active involvement of the public. For example, during consultations in the Danube River Basin, over 100 comments and suggestions were received from the public. Operational documents lay out an action plan updated every five to six years for the implementation of international treaties (*See Table 2*).



*The meeting with the ISRBC (Zagreb, Croatia). Source: CAREC*

Table 2: Operational documents of the ICPDR and the ISRBC

ICPDR	ISRBC
<p><a href="#">Danube River Basin District Management Plan developed based on the national plan on the water resource management</a> (above 700 pp., including the Annexes and Maps);</p> <ul style="list-style-type: none"> <li>• Analysis of Danube River Basin with agreed action plan until 2021.</li> </ul>	<p><a href="#">The Sava River Basin Management Plan (SRBWP)</a> (250 pp.);</p>
<p><a href="#">Strategy on Adaptation to Climate Change</a>, which includes the scenarios on climate change and how they can potentially impact underground water;</p>	<p><a href="#">Flood Risk Management Plan</a> (90 pp.)</p>
<p><a href="#">DRB Flood Risk Management Plan</a> developed on the basis of the EU Directives on Floods. The plan is built on the principle of solidarity, i.e. not to pass the problems of flooding to the downstream countries and to protect the population from flood damage (130 p.);</p>	<p><a href="#">Water and Climate Adaptation Plan for the Sava River Basin</a> (~400 pp.)</p>
<p><a href="#">Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin</a></p>	
<p><a href="#">“Sustainable Hydropower Development in the Danube Basin: Guiding principles”</a> (40 pp.), designed to strike a balance between preserving the ecosystem and providing electricity. Includes principles on technical modernization, environmental restoration, planning of new capacities, mitigation measures. The document has no legal force, advisory in nature and applied at the national level only</p>	<p><a href="#">The Strategy on Implementation of the Framework Agreement on the Sava River Basin</a> (40 pp.);</p>
<p><a href="#">Interim report on the implementation of the joint program of measures in Danube River Basin</a> (2018);</p>	<p><a href="#">Significant Water Management Issues in the Sava River Basin -Interim Overview</a>;</p>
<p><a href="#">Report on the droughts in Danube River Basin</a> (2015) related to the main consequences of the droughts and a synthesis of measures against drought by member countries.</p>	

## Budget

The budget of both the ICPDR and the ISRBC is formed from annual contributions by the Contracting Parties. In case of the ISRBC every member state contributes equally despite differences in socio-economic welfares. As for the ICPDR the contributions depend from the country. However, a contribution reduction is foreseen for countries in transition. For example, the contribution to the ICPDR's annual budget amounted to around 98,500 Euros per country in 2016 with the partial waiver granted to Ukraine and Bosnia and Herzegovina (contributing 52,455 Euros each) and Montenegro and Moldova (34,970 Euros and 11,658 Euros respectively). A significant contribution is made in form of staff and in-kind support. The Contracting Parties cover the travel costs for the Commission meetings and expert groups while the annual budget covers operating and administrative expenses, including publication costs. In 2016, the ICPDR's budget amounted to about 1 million Euros, the ISRBC operated on 500,000 Euros.

In addition, the Commissions submit project proposals for technical assistance through grants to the European Union, UNDP, GEF, the World Bank, including through a number of funds<sup>6</sup> and other development institutions. Technical support is targeted at capacity building of both Commissions, including research studies or assessments and introduction of basin-wide IT solutions. The implementation of national or transboundary projects is financed and implemented by the countries themselves.

## Economy of Danube and Sava River Basins

The Danube and Sava Rivers have significant economic importance and are a vital resource for 24 countries home to over 90 million people. They serve as the main source of drinking water, electricity generation, navigation, agriculture, nature reserves and natural habitats. Almost 80% of the population of the River Basins are supplied with drinking water from the underground waters. For example, Austria, Germany, Slovenia, Croatia, Hungary receive 90-95% of all drinking water from undergrounds of the two River Basins.

Industry - including energy generation - and mining uses 5.7 billion m<sup>3</sup> of water from the Danube River System every year. These sectors are economically important, accounting for 31-42% of the GDP of the countries in the Danube River Basin, and 29-50% of total employment. Agriculture, the cultivation of non-water-intensive crops and irrigation, mainly in Bosnia and Herzegovina, Moldova, Serbia and Ukraine, occupies up to 50% of territory in certain countries.

The Sava River Basin provides employment for almost 50% of the total number of employed populations in its basin. The service sector is the largest producer of jobs (36%), followed by the industry sector (25%) and the public sector (27%). The agricultural and energy sectors occupy a smaller share of the labor market; 11% and 1%, respectively. In general, the share of energy and agriculture in the region's economic activity is very low compared to others (4% and 7%) (*See Graphic 3, 4 and 5 in Annex 1*).

More than 85% of thermal power plants are cooled by water from the Sava River, including the nuclear power plant in Slovenia, the only nuclear power in the Sava River Basin. Lower water

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<sup>6</sup>European Regional Development Fund, European Social Fund, Cohesion Fund, European Agricultural Fund for Rural Development, European Maritime and Fisheries Fund, European Neighborhood Instrument, LIFE Entirely, Instrument for Pre-Accession Assistance, INTERREG Europe.

levels or floods threaten the energy sector and could have negative impacts on more than half of the region's electricity consumers. The largest share of hydropower generation in the region belongs in the downstream countries: Montenegro (45%), Serbia (24%), Bosnia and Herzegovina (15%) and Slovenia and Croatia (5%).

The total water use in the Sava Basin is 4.1 billion m<sup>3</sup> of which approximately two thirds is used by thermal and nuclear power plants (2.5 billion m<sup>3</sup>, 62% excluding hydropower). The supply of drinking water accounts to 760 million m<sup>3</sup> (19%). Water use in agriculture amounts to 600 million m<sup>3</sup> (12%) of which irrigation uses 30 million m<sup>3</sup> (0.70% of total water use) per year. Industrial water use is less than 300 million m<sup>3</sup> (7%).

Another important use of water in the Sava Basin is hydroelectric power. In some countries the hydro generated electricity makes from 50% up to 90% in the total power mix of Austria, Croatia, Romania, Serbia, Bosnia and Herzegovina. However, the hydro-potential is used unevenly. Large power plants are located in the Alps (reservoirs) and along major rivers (for continuous production). Dams were built in almost all mountainous regions and in some parts of the lower basin. More than 700 dams have been built on the main tributaries of the Danube River. The main drivers of disruption to the river flow are hydropower (45%), flood protection (18%) and water supply (13%) (See *Graphic 6, 7 and 8 in Annex 1*).



*Discussion on the management of the Sava River Basin, Zagreb, Croatia Source: CAREC*

**River regulation and navigation.** The Danube River is also an important transport route. With the Rhine–Main–Danube Canal, the river connects the Port of Rotterdam and the industrial centers of Western Europe with the Black Sea. 150 years ago, the riverbed of the Danube River had a shape of a fan with many river branches (similar to the existing shape of the Amudarya and Syrdarya Rivers). But, in the due course it was regulated and, as a result, the width of the river was reduced from 6 kilometers up to 450 meters. Through the regulation of the Danube River, its flow velocity intensified which made it more attractive for channel and cascade hydroelectric stations, which allows the generation of hydropower at 150 meters or lower. For example, the technical standards permit the construction of hydroelectric power stations at a level of 12 meters in Austria.

Consequently, the cascade or run of the river hydro-stations are mainly operated along the Danube River Basin. There are no large water reservoirs.

The construction of hydropower plants along the Danube River started in the 1950s, primarily to improve the navigation regime throughout the year. The responsibility for navigation rests with the states, however, as in the case of Austria, this responsibility can be transferred to the energy sector which invests in navigation infrastructure and then receives a margin for the sale of electricity. The main beneficiaries of navigation are Romania, Austria and Serbia (*See Graphic 9 in Annex 1*). In general, for navigation within the River Basin there are no fees that apply. In addition, each country is responsible for clearing siltation on its territory.

*«One country – one voice. If there is no consensus, there is no decision. The compromise must be found. There are only four countries with good and bad pasts. We should think about the future, - Melita Žižanović Dakić,  
Special Advisor for legal and general affairs, the ISRBC Secretariat.*

**Hydropower** The future utilization of huge but unevenly used hydropotential along the Danube River is vividly debated among riparian countries. Overall, hydropower is currently responsible for generating more than 45% of all renewable energy in the Danube River Basin. However, at present, it is mainly the industrial countries that benefit from the hydropotential of the river. For example, in Slovenia hydrogeneration the Danube River contributes over 60% to the country's total power mix generation. In less industrial downstream countries, it contributes less than 15%. As each country strives to realize its hydropotential, in an effort to transition to clean energy and in accordance with the European Union's Directive for Renewable Energy Sources, the share of RES generation should reach up to 40% by EU countries by 2020 (*See Graphic 10 in Annex 1*).



*Site visit to hydrostation "Freudenau (Vienna, Austria). Source: CAREC*

Harness the full hydropower potential in the region is considered the most affordable option for achieving these goals. However, given that more than 60% of the total hydropotentials has already been realized, countries are increasingly striving for small hydropower plants as an alternative. At present, 3.5% of large hydro facilities with a capacity of 10 megawatts produce almost 90% of all hydropower resources.

Despite the fact that there strategic hydroplaning is introduced at the basin or sub - basin level, there is a risk that the Danube River will turn into an artificial runoff or channel for cascading hydroelectric stations. This would lead to low energy margins, but huge environmental damage.

The ICPDR and the ISRBC do not assess the water balance<sup>7</sup> of Danube and Sava Rivers. However, this may change soon as the ICPDR is considering to launch a project to estimate the water balance in Danube River and assess balance options due to anticipated climate change impact and droughts, which may negatively impact the water resources availability within the basin. In the last fifteen years high frequency of flooding is observed, pinpointing a single cause remains difficult.



*Site visit to hydrostation “Freudenau” (Vienna, Austria). Source: CAREC*

**Agriculture** remains one of the main polluters of water resources of Danube and Sava River Basins. Over the past decades, significant progress has been made in a number of areas such as navigation, water quality monitoring and flood management, among others. However, agriculture is one of the sectors, where the least progress has been achieved.

Nutrient contamination remains high. According to historical data, pollution from nutrient was still at a satisfactory level back in 1960; however, since that time the growth of nutrient pollutants was growing. More than 50% of the Danube River Basin (about 45 million hectares) are under agricultural irrigation on which eight kilograms of nitrogen per hectare is used as fertilizer. Both

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<sup>7</sup> The water balance of a river refers to the balance between the income of water from precipitation and snowmelt and the out flow of water by evapotranspiration, groundwater recharge and streamflow.

small and large farms prevail in Danube and Sava River Basins. For example, in Romania there are more than three million small farm owners.

The issue of basin pollution is especially sensitive because of the Black Sea delta. According to a simulation results, in the case of an increase/intensity of agriculture until 2021 under a business-as-usual scenario, the level of pollution of the Black Sea will reach a depressing mark.

*Subsidy policy in agricultural* that are being put in place have made a difference already. Agricultural subsidies encourage and support farmers. Annually, more than 75% of subsidies are provided as direct payments made through the central budget of the European Union, supporting agriculture (as per the crop type) in rural areas and only 22% goes for environmental protection measures. Over the past decade, more than 70 billion Euro have been spent on agricultural subsidies, mainly supporting and diversifying earning opportunities of farmers. As a result of the subsidy policy, farmers are not interested in a large number of crops because of the risk of losing subsidies and do not strive for productivity, but to receive another package of subsidies. Quality is more important than yield.

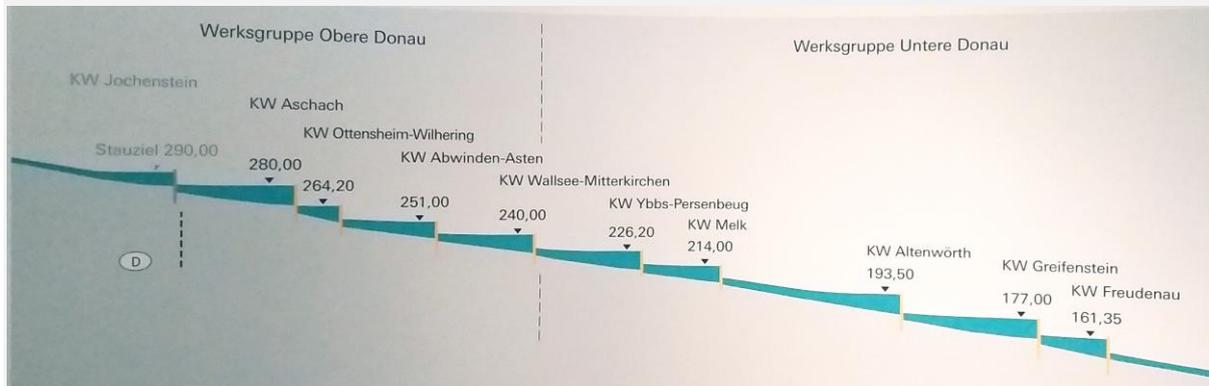
The profitability of agriculture varies among the countries of the Danube and Sava River Basin. On average, relatively low prices dominate. However, in reality subsidy policies are fragmented. In some countries, it is integrated and strongly represented; in other countries, such as Slovakia and Romania, it is weak. In other words, farmers are not sufficiently supported by this system in some countries. In addition, farmers living in countries with high GDP (for example, Germany, Slovenia) are able to provide themselves with high-quality fertilizers and thus benefit from another package of subsidies.



*Delegation from Central Asia (Vienna, Austria). Source: CAREC*

## Site visit to multipurpose hydrostation “Freudenau”, Vienna, Austria

The delegation visited hydrostation “Freudenau” of the Austrian company “Verbund”, which is owned by the Austrian Government (51%) and the private sector. The company specializes in generating hydroelectricity and wind (95%). The hydrostation “Freudenau” is one of ten cascades along the Austrian part of the Danube River (350 km.). The smallest hydrostation has a capacity of 180 megawatts generated at height of 8 meters and the largest hydrostation of 350 megawatts generated at the height of 15 meters. Located in the lower part of the cascade, the hydrostation “Freudenau” with a capacity of 170 kilowatts provides electricity to more than 80,000 households. The efficiency is 95% with a staff of 20 people.



List of “Verbund” hydrostations along Danube River

All hydrostations are multifunctional targeting at improving navigation, saving water, ecology, stabilizing the river bed and rest. The hydrostation “Freudenau” was built out of 3 million tons of concrete, enough for the construction of 350 km of high-speed highway. Typically, the cost of concrete makes 40% of the investment. In the case of the construction of a hydrostation “Freudenau”, concrete was removed at the site of the hydrostation itself.

The cost of one kilowatt of energy for the final consumer makes 3 eurocents and 30-32 per 1 megawatt for capacity market. According to the policy of the European Union, the energy sector is not entitled to set its own prices for electricity sale.

The water discharge measurements are taken four times a day to ensure a stable watercourse. Every ten years, a complete remeasurement of water discharge is carried out.

Annually the company allocates more than 65 million Euros for environmental measures. By 2027, the company intends to build fish passages in the areas nearby hydrostations. In addition, the company collects garbage on rivers and lakes. In 2010, company “Verbund” opened a climate school in one of its national parks.

About 4,000 hectares on the territories nearby the hydrostations are declared as nature reserves. Over 400,000 visitors annually visit energy facilities as a tourist attraction.

Agricultural producers do not pay for irrigation water and there is no water metering. Austria is doubly in a favorable position due to geographical conditions, which provides a huge influx of water. Austrian farmers can use the water as much as they need for free and without any permits for irrigation water resources. It is important to keep in mind that the region does not suffer from water shortage. Instead water quality is the main issue of concern in the two basins. Improving water quality in the Danube and Sava River Basins will be impossible without reducing pollution from agriculture. It will be necessary to continue changing the paradigm of thinking without affecting the farmers’ income and advance cooperation with the ICPDR and the ISRBC. The ambition of such cooperation is to separate the economic development of farmers from river pollution, which cannot be done without affecting the European Union agricultural policy. In line with the EC initiative of water and agricultural policies in the common agricultural program (CAP), the ICPDR has launched a dialogue with the agricultural sector aiming at the development of a guidance document on sustainable agriculture, which will be available by 2020.

The common agricultural program post 2020 (CAP Post 2020) of the European Union is being developed, which considers agriculture at the basin level in order to reduce river pollution by nutrients. The ICPDR is actively engaged in the development of the draft programme and provided suggestions in the form of a Position Paper. The recommendations of the ICPDR can be found in the Position Paper<sup>8</sup>.

*«It would be interesting to consider a return to the practice of flood irrigation in our region», - Bolat Bekniyaz, Director of the Executive Board of IFAS in the Republic of Kazakhstan*

**Waste water** from the urban environment and industry is also one of the major pollutants affecting water quality. As of 2018, about 90 million people in the Danube River Basin produce more than 10 million cubic meters of sewage every day. Over 250 large industrial facilities are located in the Danube River Basin, storing more than 6.5 million tons of hazardous substances. The main part of wastewater is collected by the sewer network collector or treated by local technology (80%). Another part of wastewater is treated in centralized wastewater treatment plants. There is a need to increase the collection and processing of the remaining part of wastewater.

Over the past twelve years, Danube River Basin countries have invested over 200 billion Euros in the construction and modernization of sewage systems and wastewater treatment plants. More than 400 industrial facilities have been certified to raise technological standards. The percentage of the number of settlements and industrial facilities connected to sewage and sewage treatment plants has increased significantly (reaching almost 75% of the Danube River Basin). However, some sources of contamination by hazardous substances remain unknown. There is only limited information on the results of an inventory of industrial facilities.

*International treaty on Danube River Basin exceptionally highlights that the Contracting Parties are responsible for water quality on its territory.*

Thirty years ago, the Danube River was much more polluted. According to the results of large-scale monitoring of the entire basin, potentially 25% of the river meets the requirements for water quality and environmental conditions. 71% of the river has good water quality conditions. 13% of the groundwater shared by several countries has conditions of poor water quality, which should be improved by 2027. 17% of the river is below the expectation level.

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<sup>8</sup> <https://www.icpdr.org/main/icpdr-publishes-position-paper-post-2020-common-agricultural-policy-and-water-management-danube>

### Site Visit to Lonjsko Polje Nature Park, Croatia

Participants visited the Lonjsko Polje Nature Park, which is located in the Sava River Basin, in the north-central part of Croatia. It comprises 14 settlements and with 50,650 hectares is one of the largest protected wetland areas. The park is a vast floodplain along the Sava River, covered by oak alluvial forest, alder swamp forests, wet meadows and pastures.

The main land-use activities in the park include grazing, hunting, fishing and water management. Lonjsko Polje provides many benefits, from natural floodplains, the preservation of rare animals and plants, spawning areas for fish, traditional systems of pasturing, traditional systems of land-use as well as a wealth of intangible cultural heritage, including songs, dances and customs.

At the time of the study tour visit, large amounts of precipitation allowed participants to see the flood control system in action and the use of natural floodplains. 82% of the Nature Park area is a flood zone, with 25,630 hectares part of the controlled floodwater retention zone. 71% of the park's area are forest and 20% are covered by grassland.

## Technical maintenance

The ICPDR and the ISRBC use a number of accessible IT platforms mainly for data and information exchange on monitoring of water quality and quantity. However, the Commissions are not data providers. Instead, the Contracting Parties submit data at the national level while the Commissions only provide the platforms for the exchange of harmonized and standardized data among member countries. The need for joint flood forecasting is recognized by all basin countries and the exchange of data and its analysis are used to prevent and analyze future scenarios.

The following technical tools are operated by the ICPDR (*See Picture 2*):

1. ***The Danube Accident Emergency Warning System*** is activated every time when there is a risk of transboundary pollution or the permissible level of hazardous substances increases. The early warning system sends warning messages to the downstream countries along the established route. Data on the incident, causes, location, time and particles of hazardous substances and measures that have been taken are collected according to established forms and are automatically translated into the recipient's language;
2. ***The transnational monitoring network*** aims to collect and analyze the concentration of pollutants to provide information about the quality of surface and groundwater. There are 114 monitoring points located throughout the Danube River Basin and its main tributaries. At least 12 times a year surface water samples are taken for chemical parameters and once or twice a year for selected biological parameters. Every six years, comprehensive monitoring is carried out. Within a few weeks, all participating countries collect data on pollutants and analyze them. The results indicate where efforts should be directed to improve the quality of water surfaces. The next monitoring for the first time will include microplastic monitoring;
3. ***The flood risk maps*** were prepared, identifying districts vulnerabilities to natural disasters, visualized along a set disaster scale;
4. ***The MONERIS model*** calculates nitrogen and phosphorus emissions into surface waters along various paths, as well as flow retention in a surface water network.

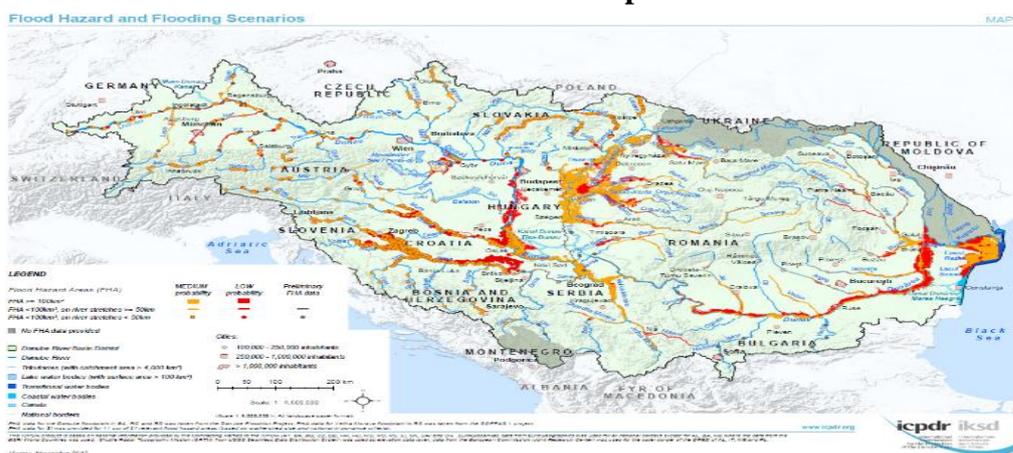
Picture 2: the ICPDR's IT platforms

**The Danube Accident Emergency Warning System (AEWS)**

**The transnational monitoring network (TNMN)**



**The flood risk maps**



Source: the ICPDR

In regards to the ISRBC, there are also a number of operational IT platforms (See Picture 3):

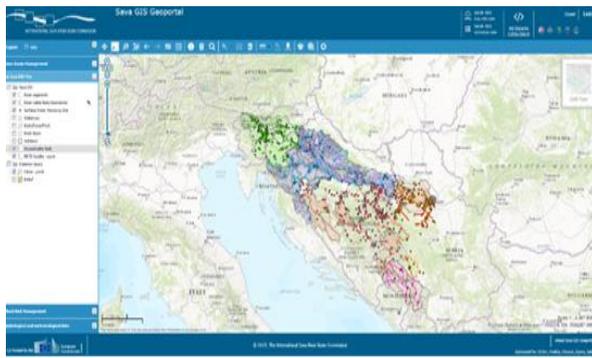
- i) **Sava GIS** is a common platform for sharing and disseminating of information. It is a mega catalog of data on the Sava River Basin, including a flood map, flood protection, flood risk assessment, a flow control module for collecting spatial and attribute data, and historical data (topographic, surface and ground waters, protected areas, urban wastewater floods). It is an open source platform where only registration is required to download data;
- ii) **The flood forecasting and warning system** is a server-based application on the Delft-FEWS software that contains meteorological and meteorological metadata, different forecasting and modeling tools, as well as a warning system for downstream countries. The systems are located in the countries themselves. The main host is situated in Slovenia, backed up in Bosnia and Herzegovina, Croatia and Serbia. The archive and web server are stored at the Sava Commission. Users can calibrate data and import models. A video monitoring system has not been installed in any country as well as at ISRBC. Member states approve what kind of data should be publicly available. The

participating countries and nineteen national and research organizations participated directly in the development of this system;

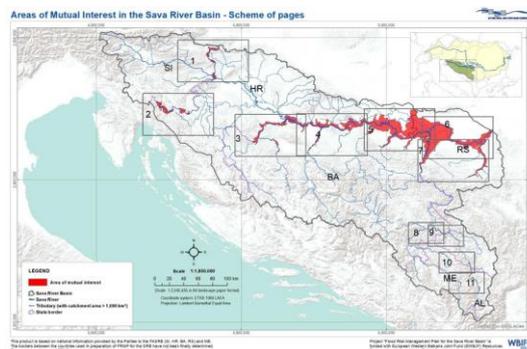
- iii) **Hydrological and hydraulic modeling**, with the support of the U.S. Government and the U.S. Army Corps, allowed to produce twenty-two hydrological flood simulations and identify 251 potential flood sites. The information was provided to countries and integrated into the ISRBC flood warning system.

Picture 3: the ISRBC's IT platforms

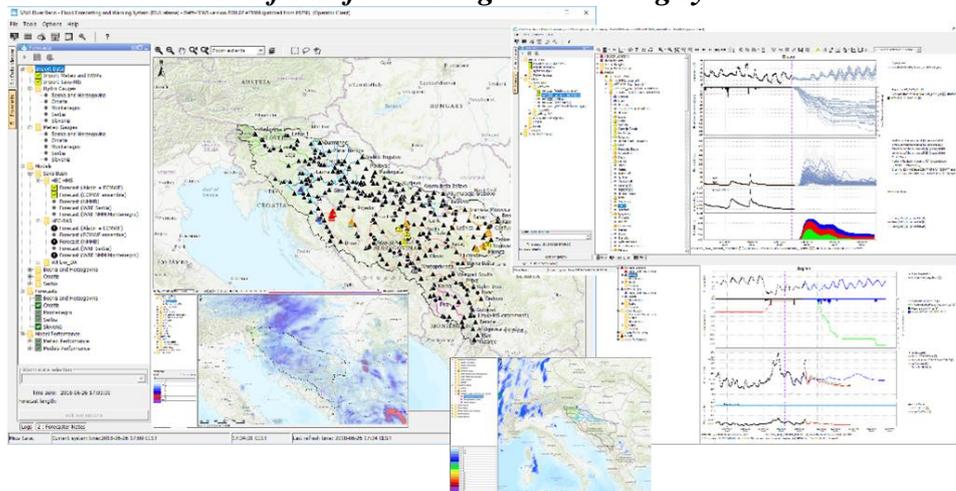
**Sava GIS**



**Flood modelling**



**The flood forecasting and warning system**



Source: the ISRBC

*«It was a good example on how low-cost information technology can be used for different tasks at the basin level,»- Bolat Bekniyaz, Director of the Executive Board of IFAS in the Republic of Kazakhstan*

## Work with community

The ICPDR and the ISRBC welcome and support the active involvement of stakeholders and civil society on all level of its work. This is pursued through public consultation activities for the development of management plans. As practice shows, the received comments are considered in the final drafts. To ensure a high level of public information, educational and outreach initiatives support the public participation work of both institutions.

In 2018, the ICPDR opened its on social media networks and is now active on Facebook, Instagram, Twitter, YouTube, and LinkedIn. Quarterly magazines such as “Danube Watch” and “Sava NewsFlash” give a snapshot on activities, initiatives and highlights as well as interviews with experts and local populations.

Each summer, both Commissions engage the local communities in summer festivals and celebrations of the Europe's greatest river systems and the people and wildlife that rely on it. For the ICPDR, on 29 June and beyond, “Danube Day” marks the signing of the *Danube River Protection Convention*. For “Sava Day”, festivals, contests and expeditions are organized throughout the basin. With the growth of activity and interest of the population, the celebration of the "Danube Day" was extended form one day to the entire summer. In 2018, 450 organizations were involved in the organization of more than 200 events in 14 countries with over 30,000 participants. Events were suitable for different age categories. For example, the Danube Art Masters Competition – jointly organised by the Global Water Partnership Central and Eastern Europe (GWP CEE) and the ICPDR encourages children to have a closer look at their local river, to reflect on what the environment means to them, and to create original artworks to celebrate the region.

In 2018, more than 100 residents of the River Basin participated in the “Big Jump” campaign organized by WWF in the Danube River to demonstrate their attachment to the river.

The ISRBC has also established the Sava Youth Parliament, a platform that presents a golden opportunity for young people to present their environmental works – introducing a new topic every year. In 2015, a round table was conducted in Zagreb with participation of more than eighty representatives from academia, NGOs, the private sector to jointly discuss basin management plans and flood protection measures.



*«Over the past two years, Central Asia started celebrating “The Days of Aral Sea”. It would be useful to cooperate with the Commissions during the celebration,»- Bolat Bekniyaz, Director of the Executive Board of IFAS in the Republic of Kazakhstan*

## Conclusion

The visit of the delegation from Central Asia to Vienna, Austria, and Zagreb, Croatia, has proven valuable in witnessing the potential of collaboration on transboundary water resources management. Although the challenges faced are different from those in Central Asia, participants understood how the riparian countries in Eastern and Central Europe renewed the water collaboration by developing new legislative and institutional frameworks viable in the post 1990 political paradigm. For the last decades, the set framework under the ICPDR and the ISRBC ensured dialogue between riparian countries and allowed for the operationalization of monitoring, emergency warning and forecast systems.

As per the feedback of members of the Central Asian delegation, agreeing on a proper legislative framework from the very beginning is key to successful regional cooperation. The case of the Sava River Basin may at some point be relevant to Central Asia because the countries gained independence over night, after the collapse of the Soviet Union and Yugoslavia respectively, and had to manage the water resources themselves.

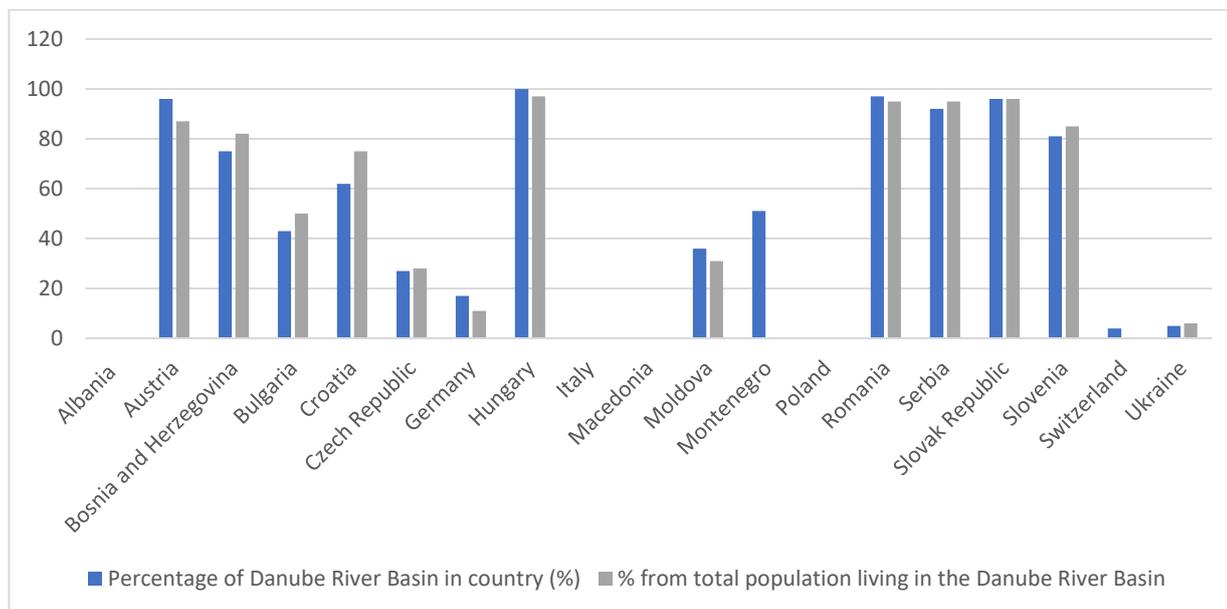
While riparian countries lead the infrastructure development at the national level, the ICPDR and the ISRBC provide the platform to discuss national plans at the regional level. Remarkably, the ICPDR and the ISRBC in due course turned into platforms that bring together not only riparian countries but later also representatives from the WEF sectors, private businesses, NGOs and other stakeholders to discuss current issues, challenges and potential solutions.

The annual celebration of the Danube and Sava Rivers across the basins showcased the importance and admiration of external stakeholders in caring about regional natural resources and their readiness to provide inputs. The use of low-cost IT technology was noted by the delegation as efficient instrument, which are worth for consideration for Central Asia.

To conclude, regardless of the challenges in managing regional water, enforced legislation combined with strong institutional structures is a receipt of success for riparian countries' commitment for the sake of regional collaboration and environmental safeguard.

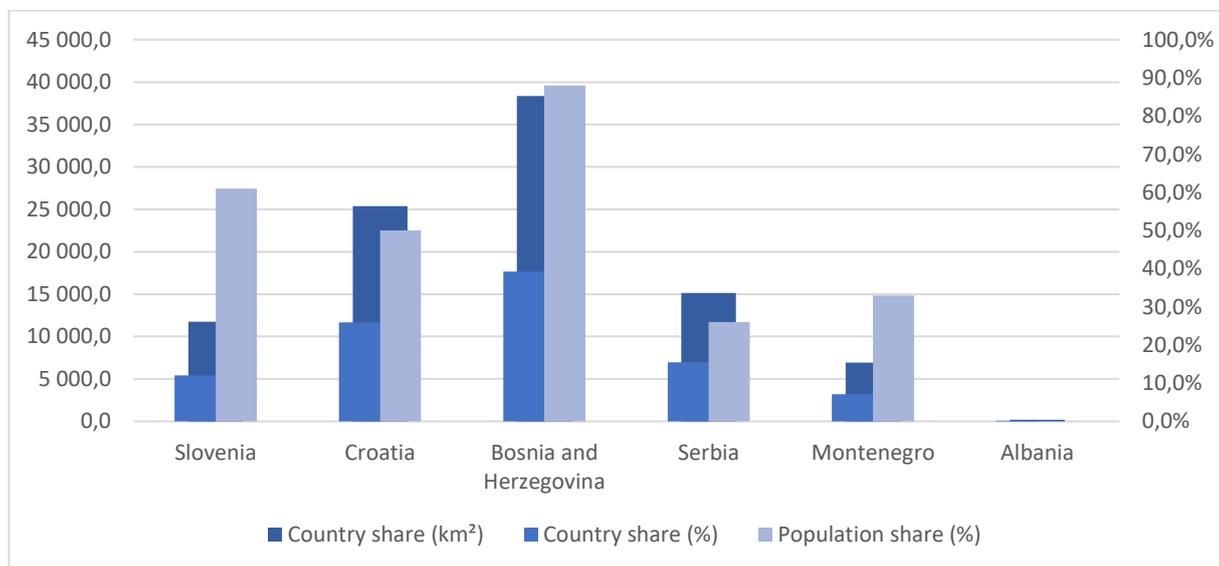
## Annex 1: Data on the Danube and the Sava River Basins

Graphic 1: Coverage per country in the Danube River Basin



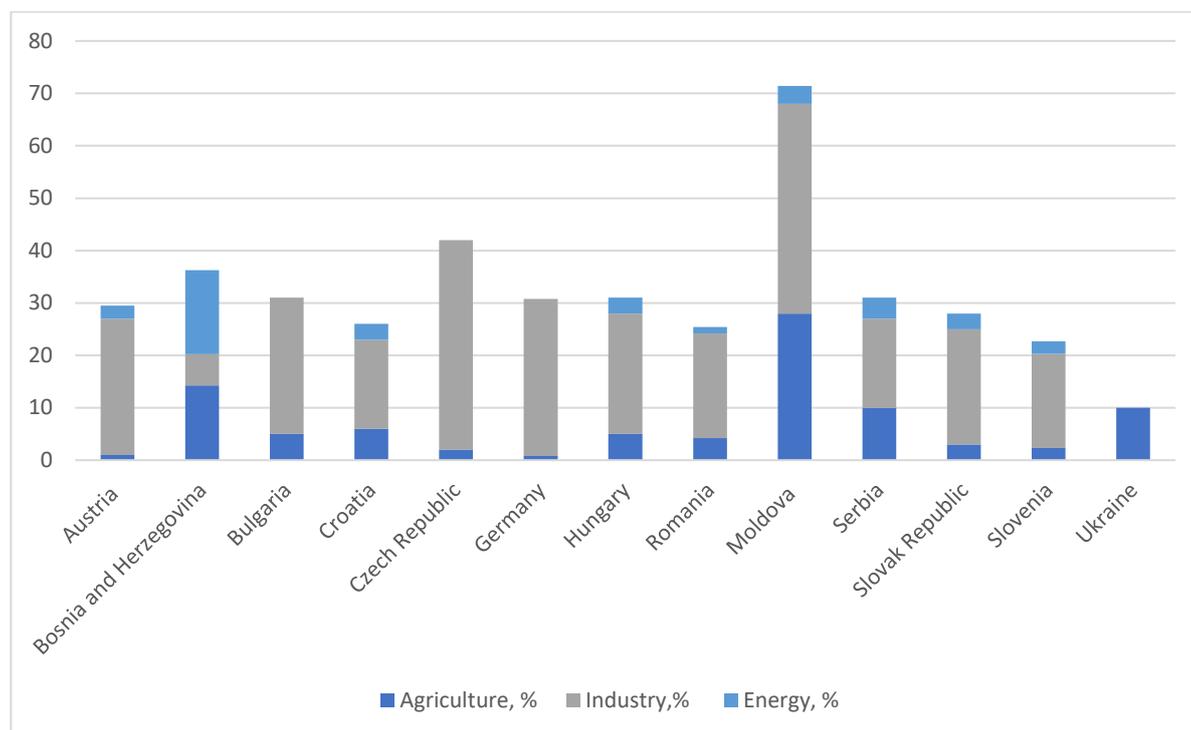
Source: *The Danube River Basin, Facts and Figures, ICPDR*

Graphic 2: Territorial share of riparian countries in the Sava River Basin



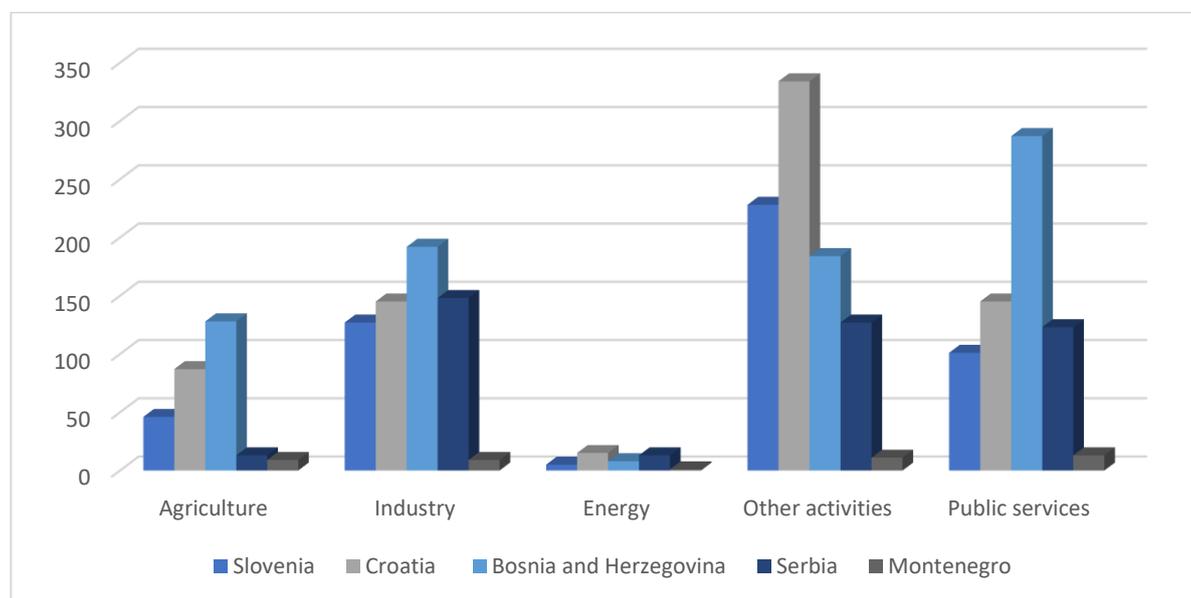
Source: *2nd Sava River Basin Analysis, 2013, ISRBC*

*Graphic 3: Main economic activities in Danube River Basin, share of GDP, % (national level)*



Sources: Danube countries, data collection via ICPDR PM EG, 2011/2012. Categorization is based on the highest technology level available

*Graphic 4: Employed people in the Sava Basin by sector*



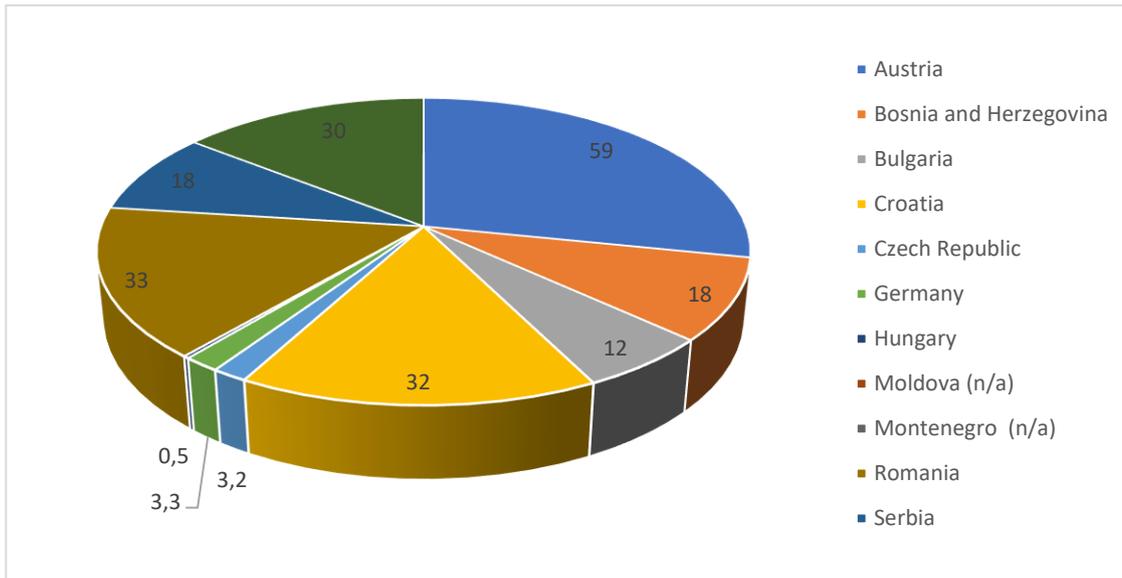
Source: 2nd Sava River Basin Analysis, 2013, ISRBC

Graphic 5: GDP per sector in Sava River Basin



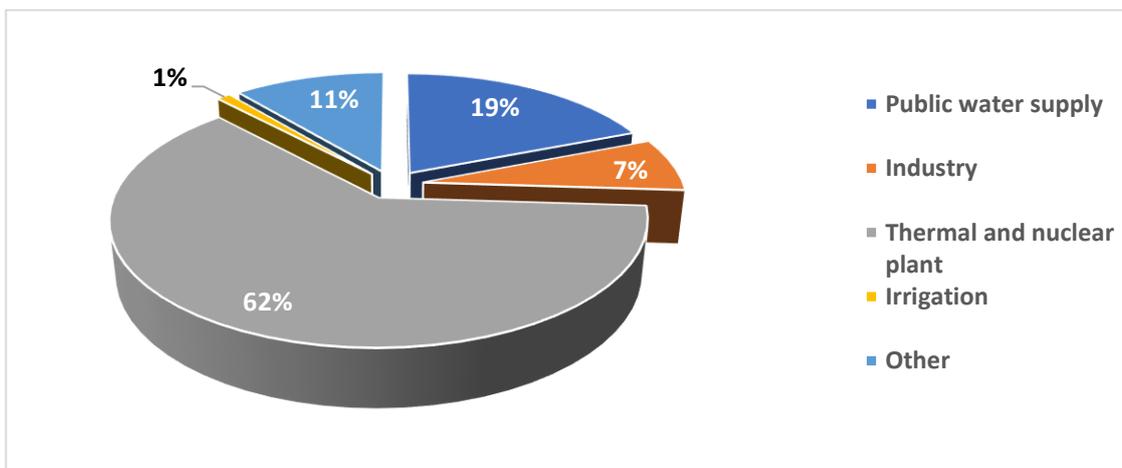
Source: 2nd Sava River Basin Analysis, 2013, ISRBC

Graphic 6: Share of hydropower generation in power mix, %



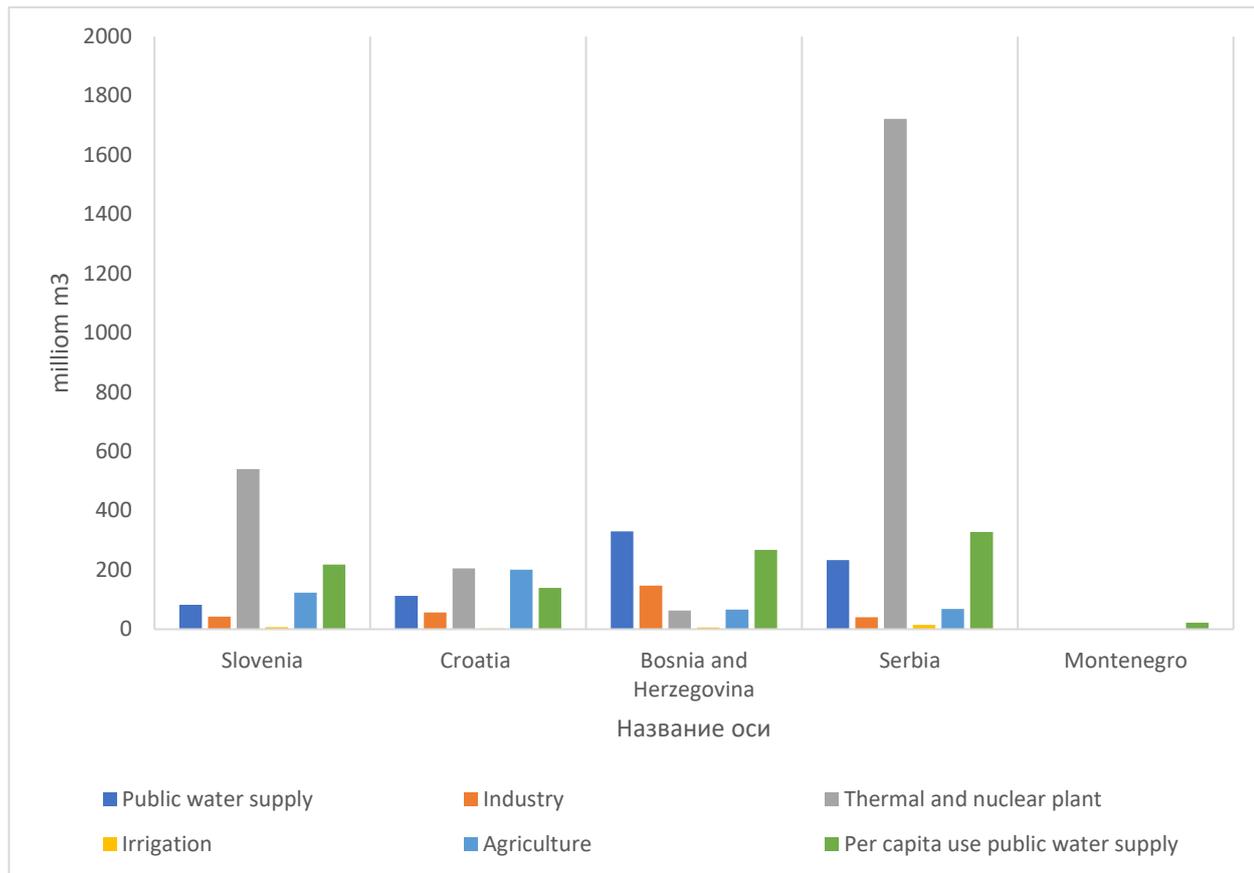
Source: The 2013 Update of the Danube Basin Analysis Report, ICPDR

Graphic 7 Extraction by sectors in the Sava River Basin



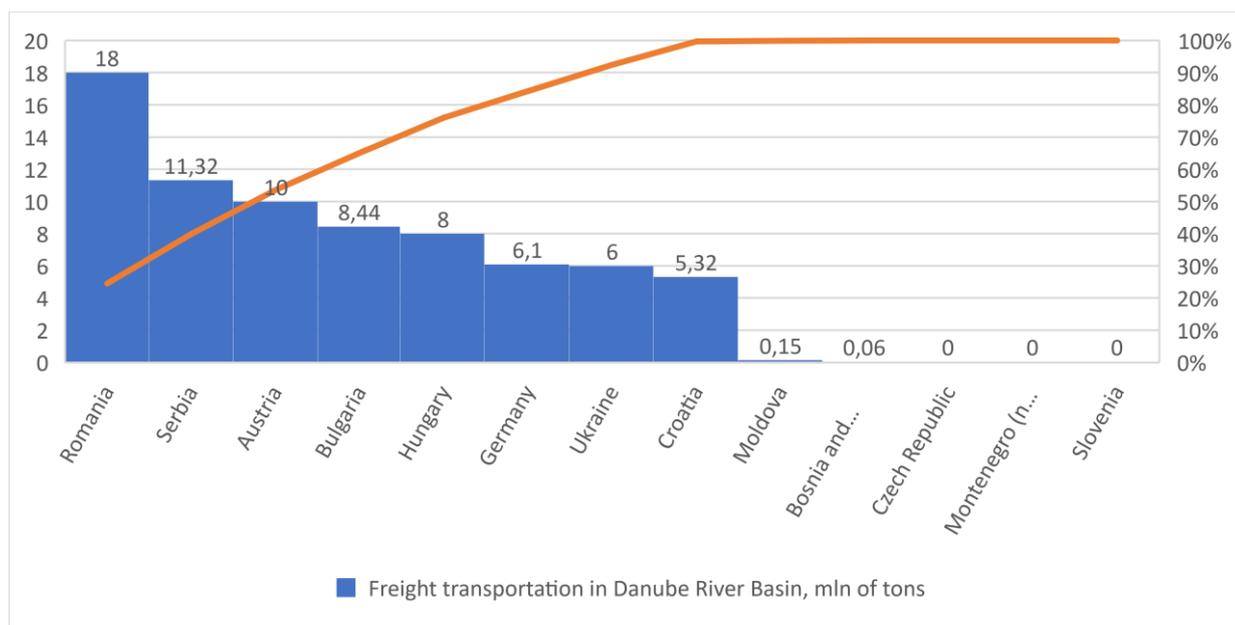
Source: 2nd Sava River Basin Analysis, 2013, ISRBC

Graphic 8: Water extraction by countries in Sava River Basin



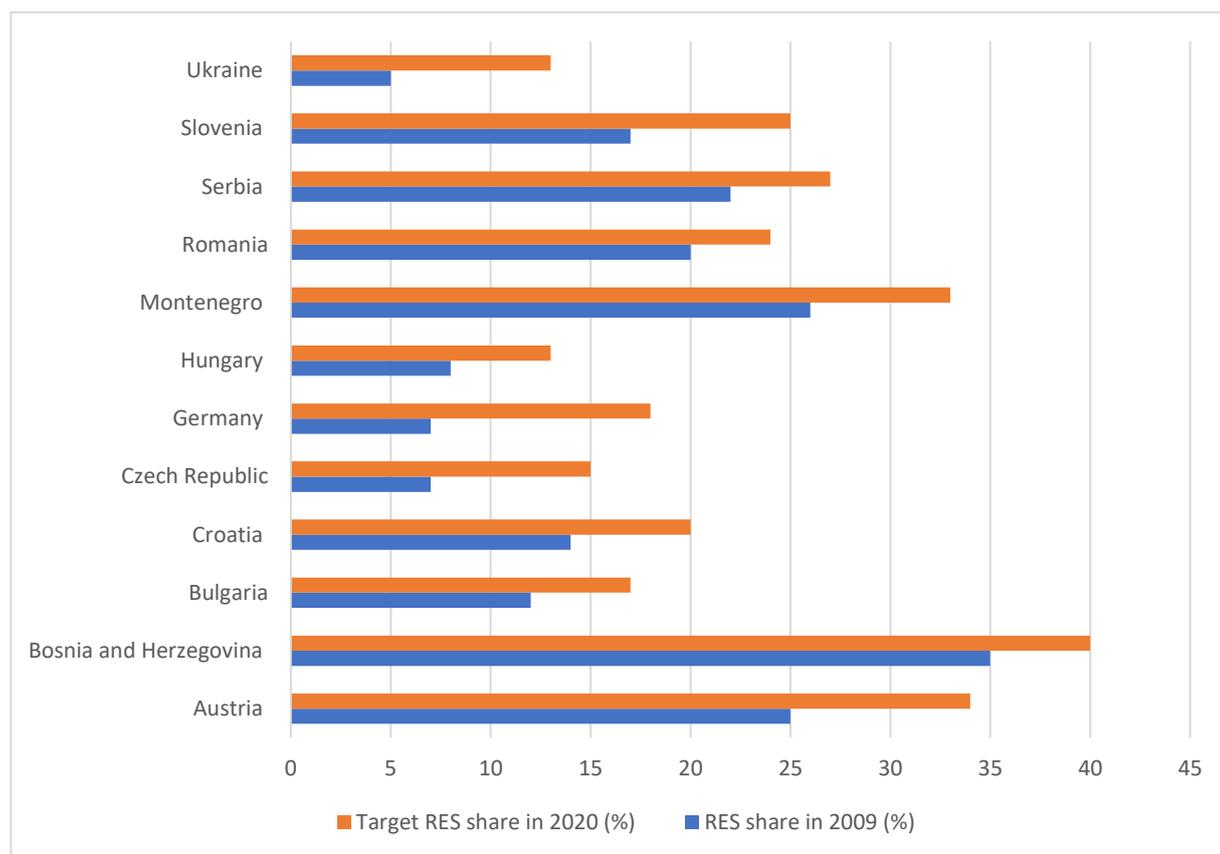
Source: 2nd Sava River Basin Analysis, 2013, ISRBC

Graphic 9: Inland navigation in the Danube River Basin



Source: The 2013 Update of the Danube Basin Analysis Report, ICPDR  
 \*This figure includes the data related to the Danube – Black Sea channel.

Graphic 10: Share of energy from renewable sources in gross final consumption of energy



Source: Assessment Report on Hydropower Generation in the Danube Basin, ICPDR 2013