Drina River Basin nexus assessment - Phase II

National Consultation meeting

KTH – Royal Institute of Technology:
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Agenda

- Key questions
- Scenarios
- Approach
- The river basin
- Preliminary results
- Hydro power plant cascade

Key questions to be addressed in Phase II

- What role can renewables (hydro and non-hydro) in the Drina basin play in achieving the UNFCCC Nationally Determined Contributions?
- What benefits does an increased share of non-hydro RES bring in terms of GHG emissions reduction and reduced stress on hydro power especially considering the need for flood containment measures.
  - To what extent may hydro power plants provide environmental services (e.g. environmental flows and flood control), and what impact does that have on their potential generation?
- What are the effects of climate induced variability on hydropower generation?
- What role could non-hydro RES play if the proposed plans for HPP development in the DRB are executed?
- What effects can the Emission Trading Scheme, as part of the EU integration pathway, have on hydro and non-hydro RES development in the riparian countries?
- In which way can hydro and non-hydro RES be impacted by the implementation of energy efficiency measures (demand- and supply-side)?

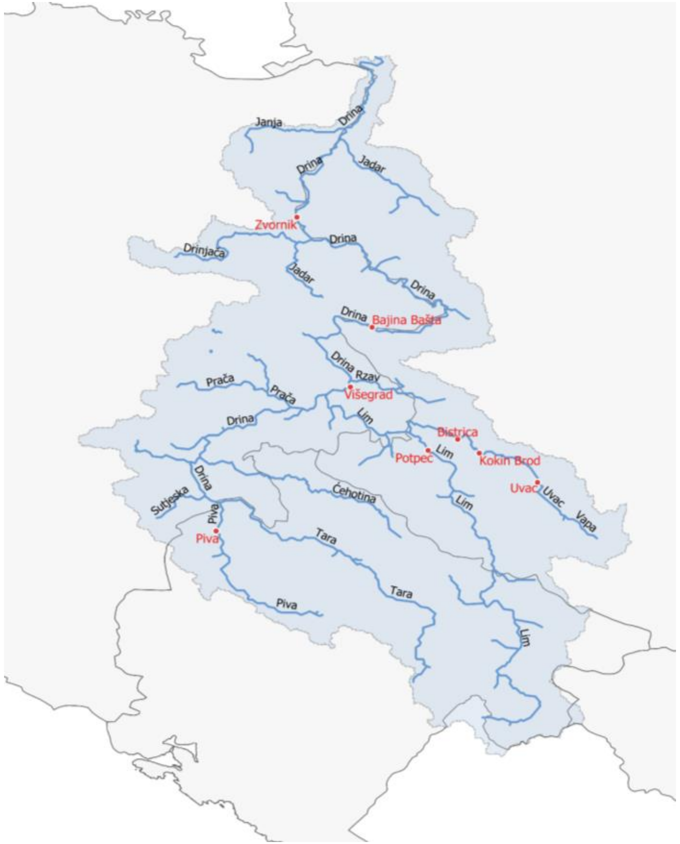
Scenarios proposed in Phase II

- **Reference scenario**
    - Current policies, including INDC
- **Carbon pricing scenario**
    - Effects of the ETS
- **Energy efficiency scenario**
    - Impact of EE measures
- **Hydro development scenario**
    - Expanding hydro in the DRB
- **Environmental services scenario**
    - Dam storage capacity changes
- **Climate mitigation and adaptation scenario**
    - Changes in RES prices

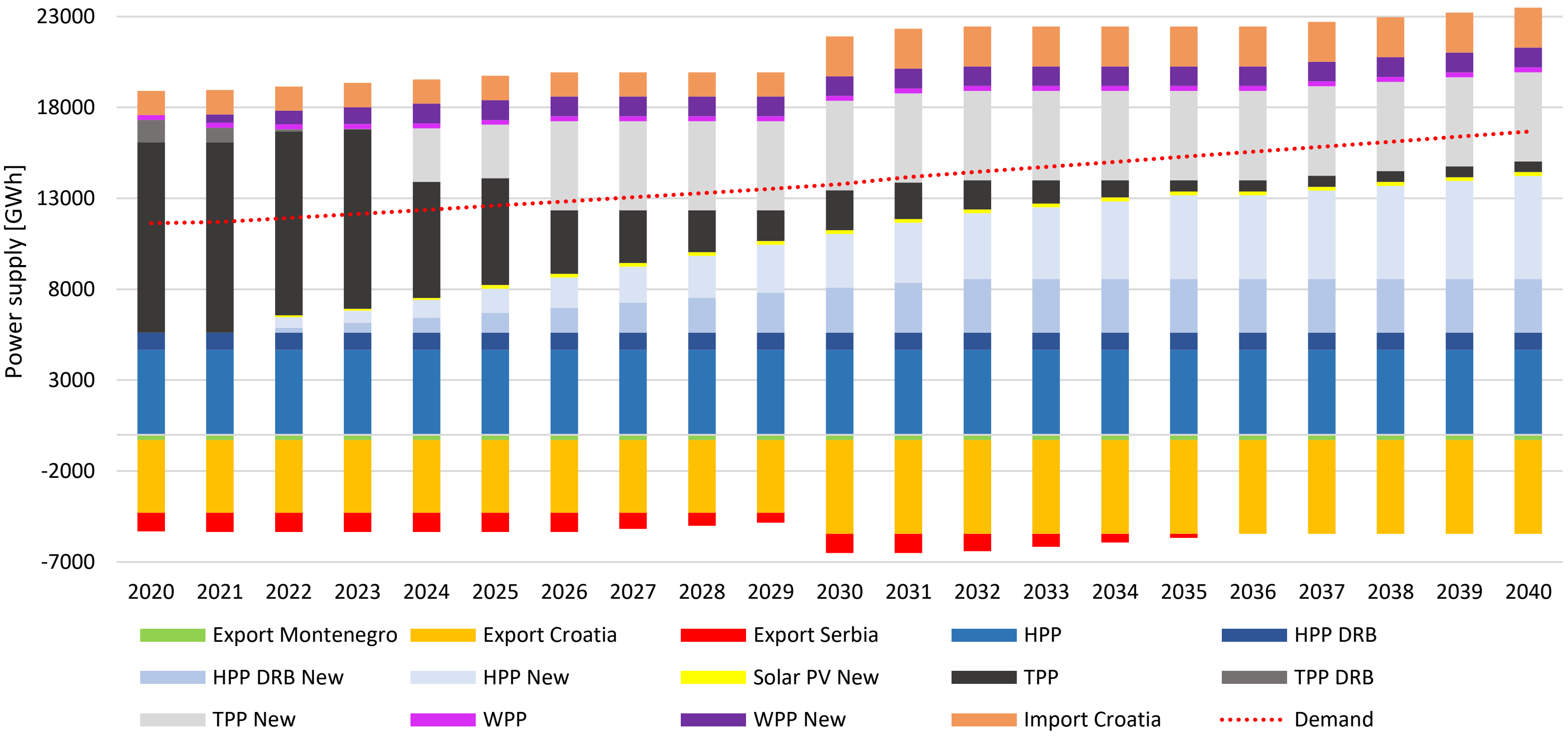
Approach

- Electricity sector expansion model developed with OSeMOSYS (open source framework) from Phase I will be used
- The model is a techno/economic least cost optimization model of the power sector
- Power sector in all three Drina riparian countries (BA, ME and RS) represented – scenario analysis to obtain insights related to the key questions of the project
- Emphasis on the operation of hydropower in cascade as well as the effects of non-hydro RES on hydropower and flood control/environmental flows

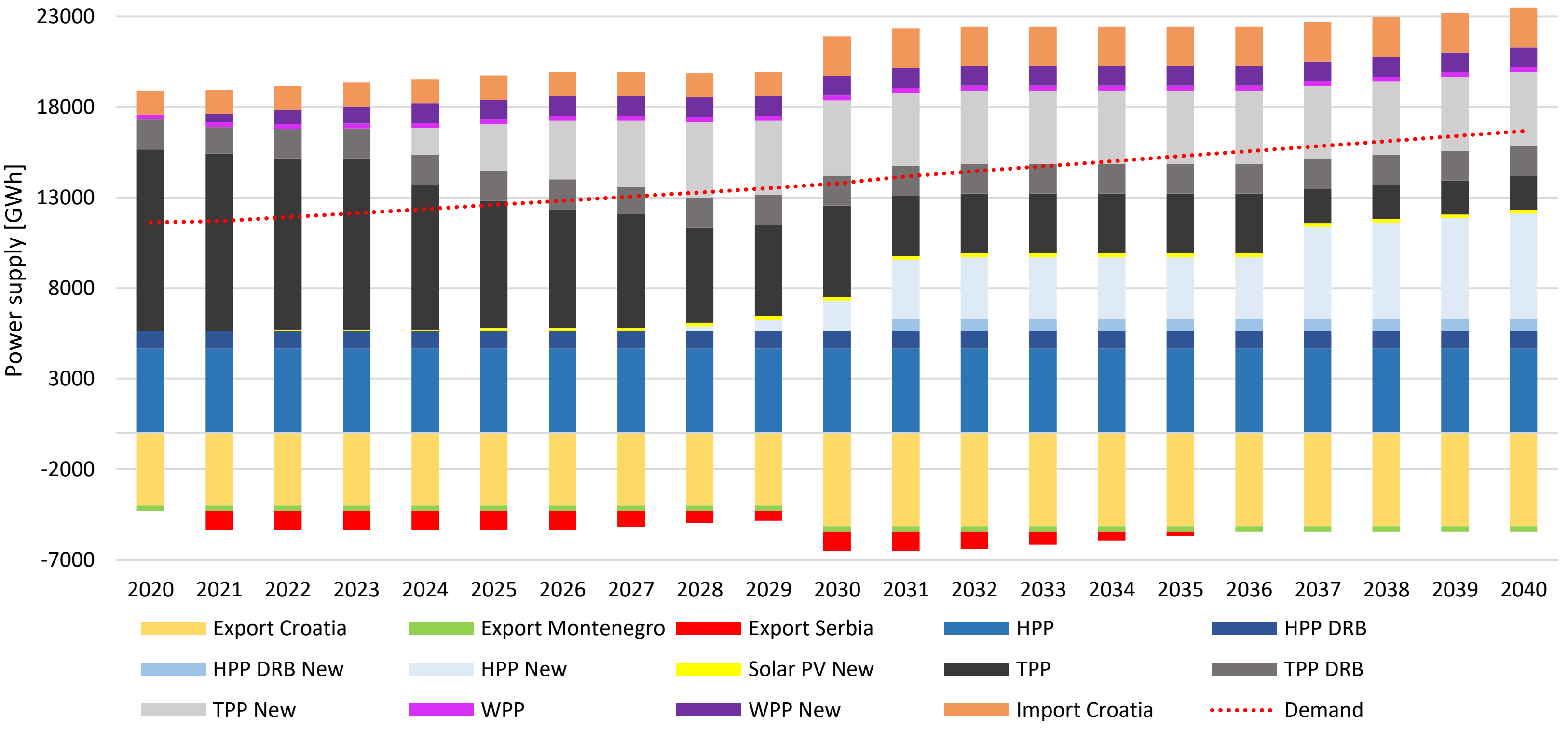
Map of the Drina River Basin



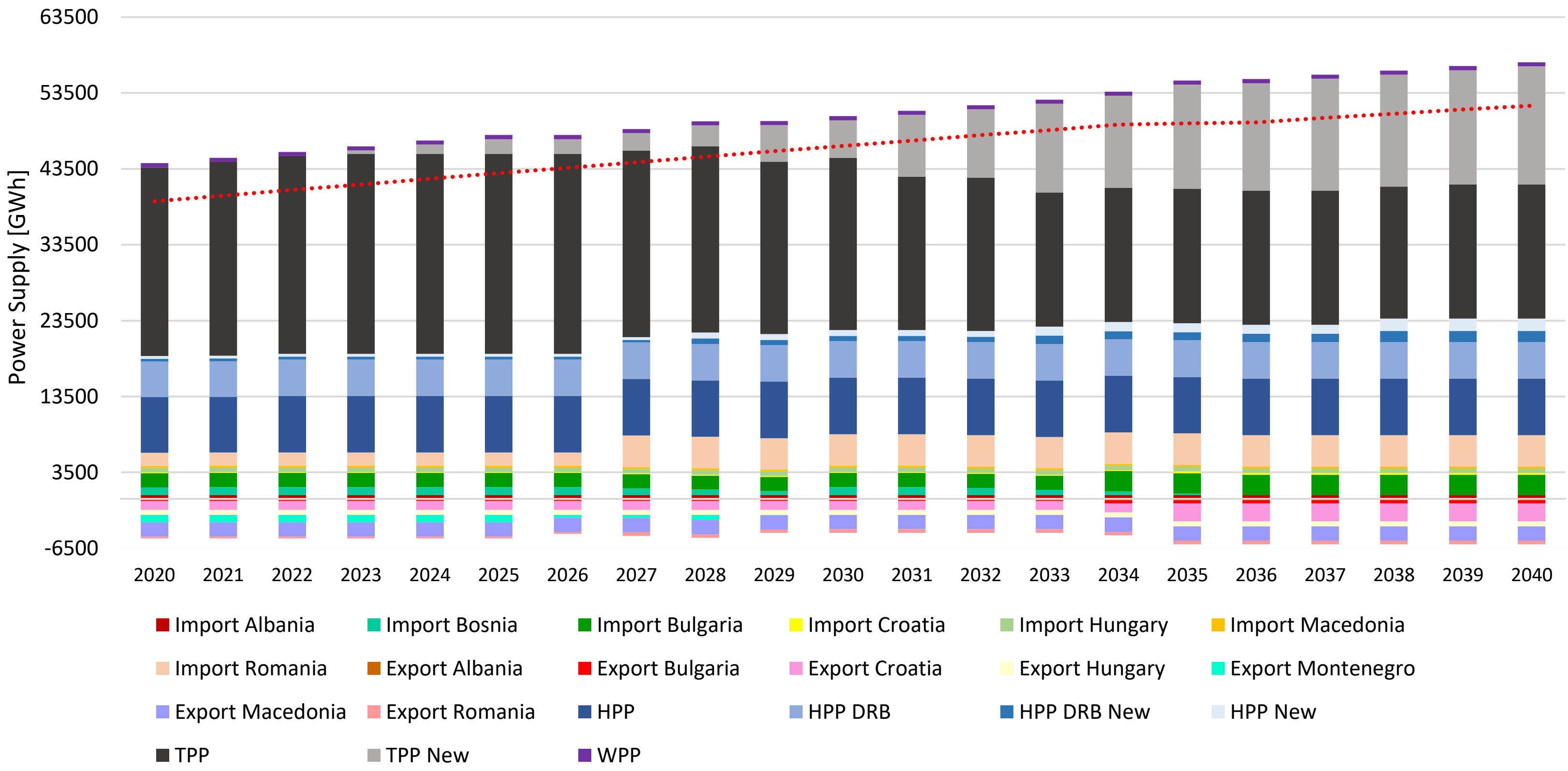
Production by technology Bosnia and Herzegovina 2020-2040 [cost-optimized]



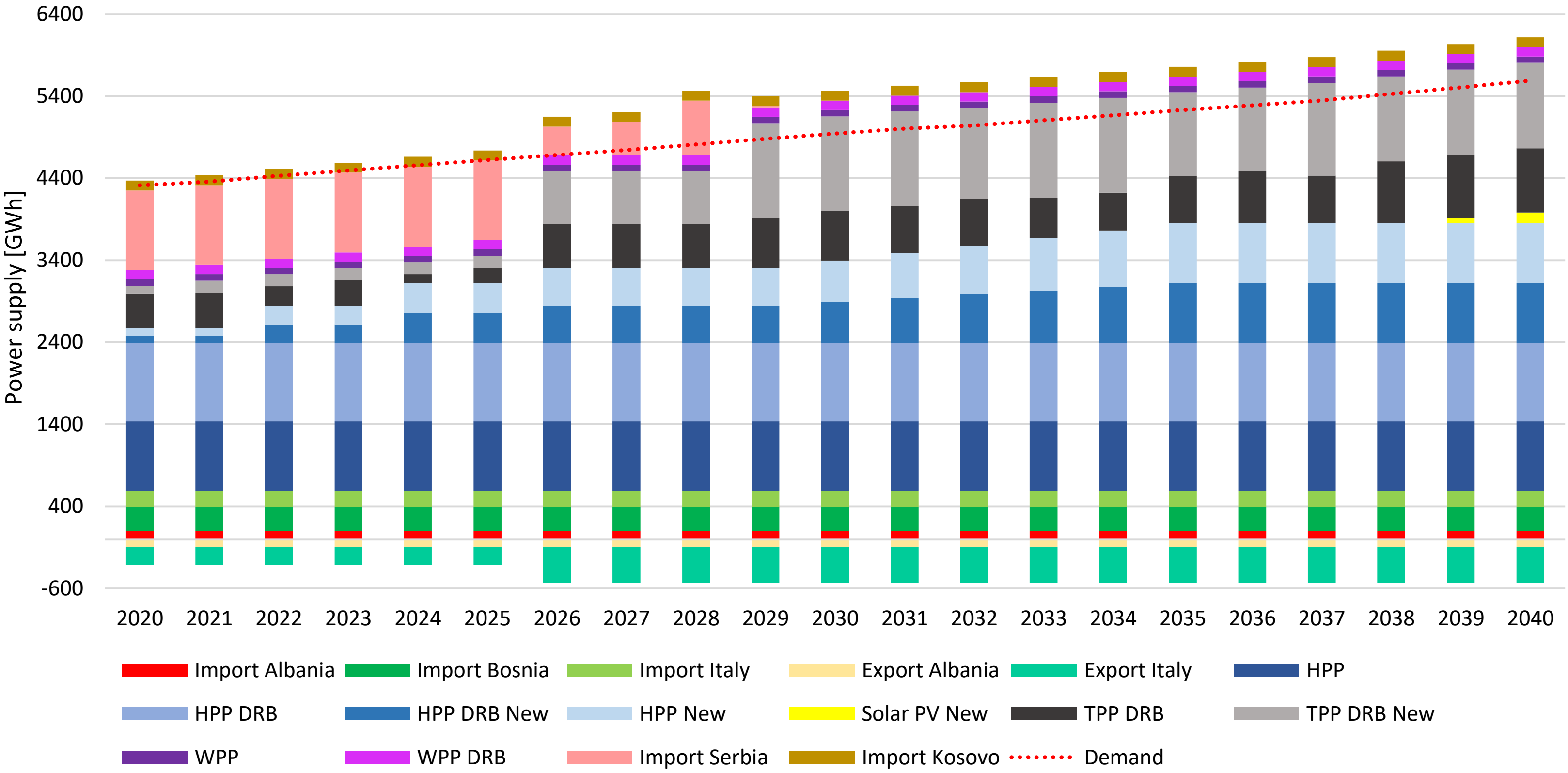
Production by technology Bosnia and Herzegovina 2020-2040 [IPRP 2021-2030 TPP production]



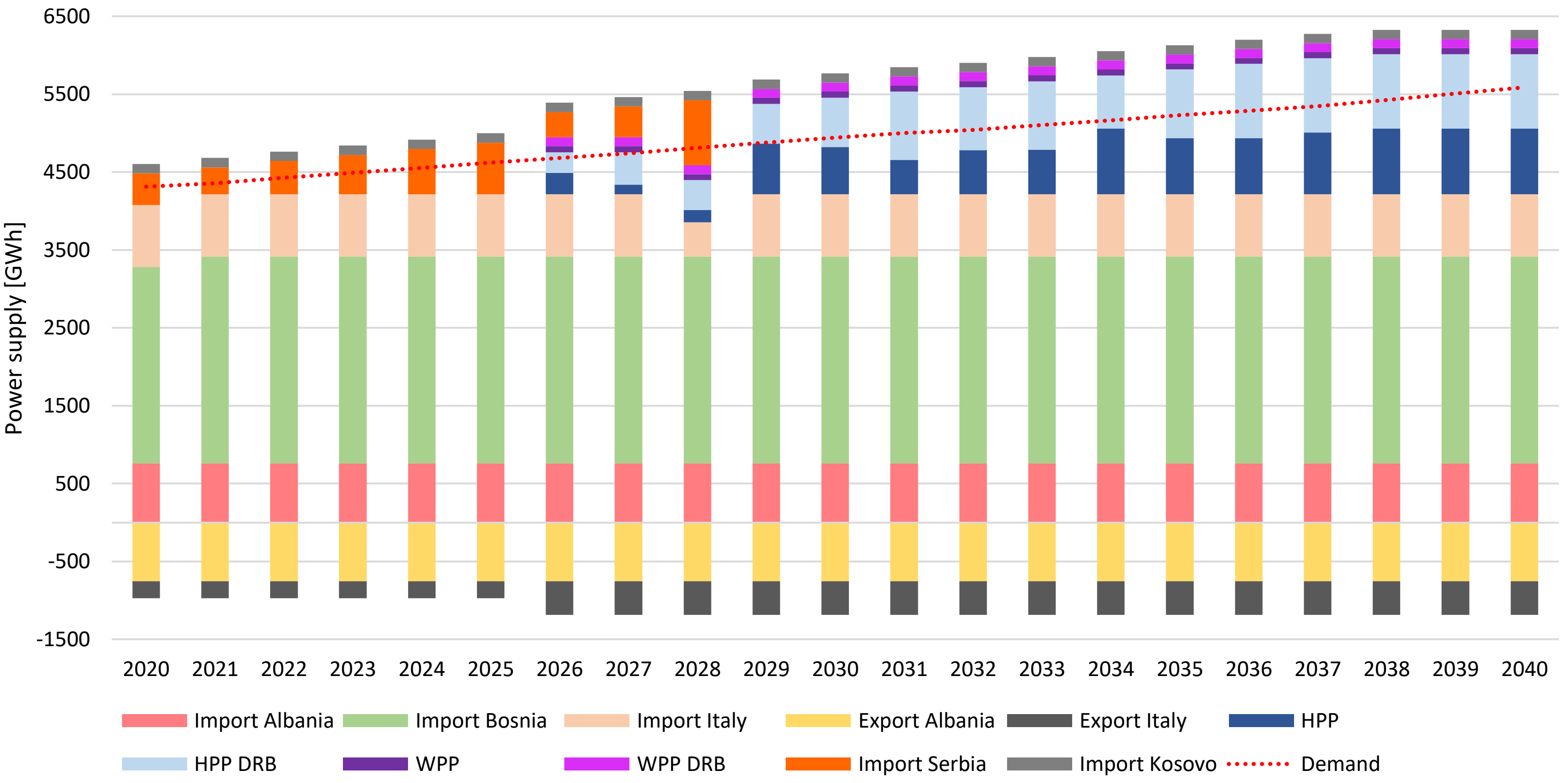
Production by technology Republic of Serbia 2020-2040



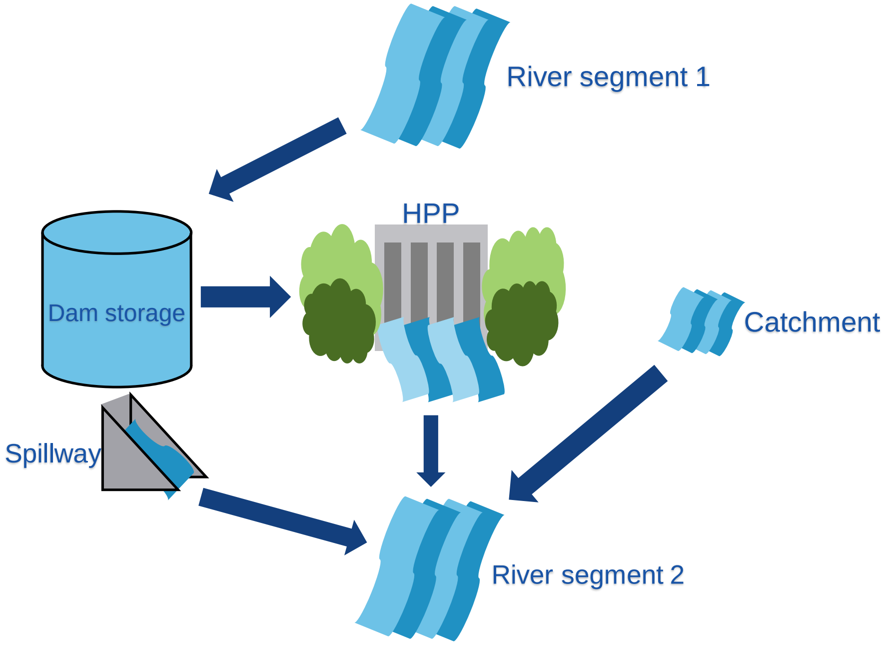
Production by technology Montenegro 2020-2040



Production by technology Montenegro 2020-2040



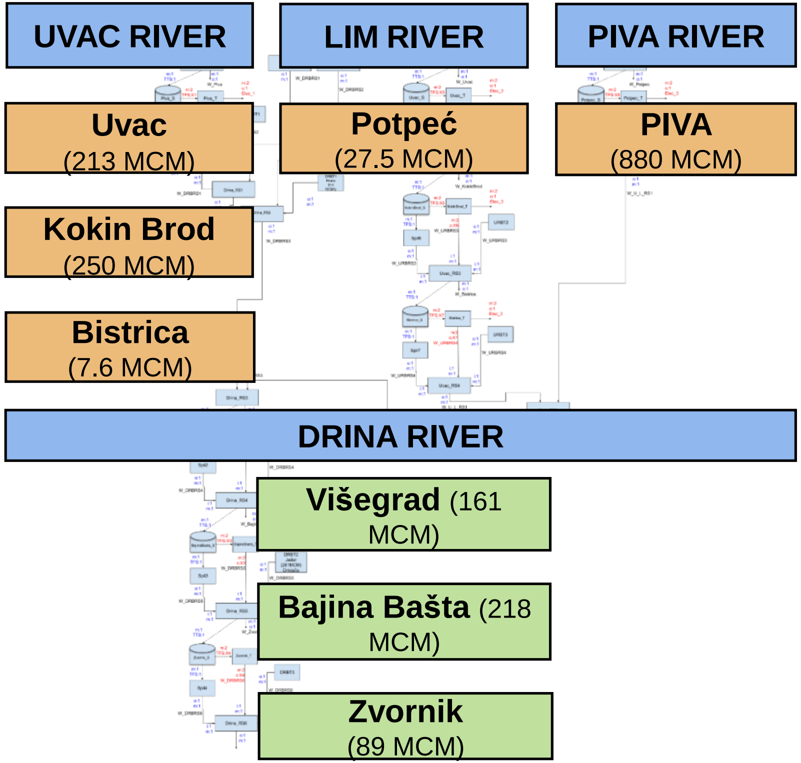
Concept of the hydro power plant cascade model



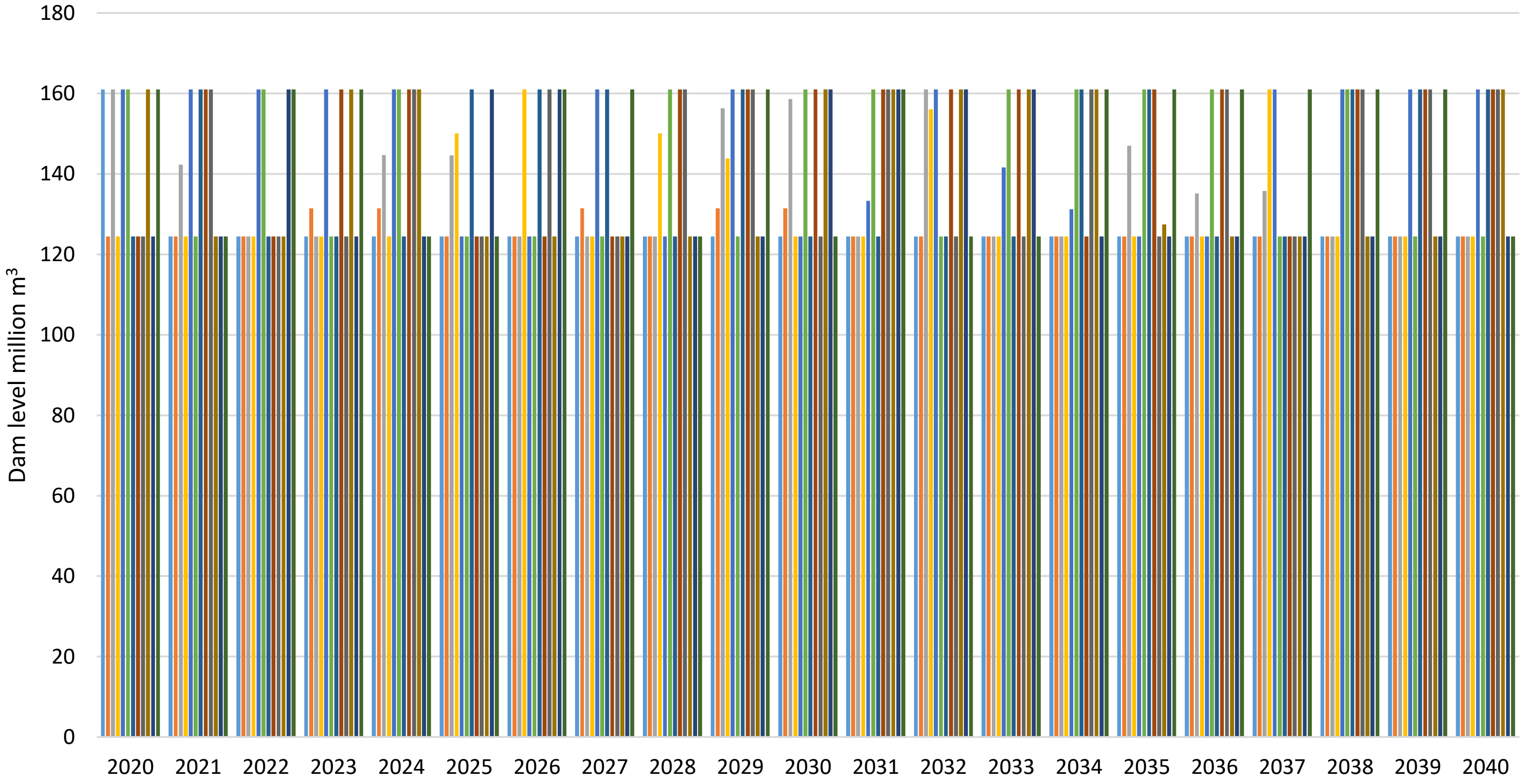
- Floods and droughts controlled by upstream river segments and catchments
- Considers water availability, operational rules, environmental flows
- Discharges [m^3/s] for *normal years* based on monthly multi-year average flows
- **Inputs**: dam storage [MCM], monthly discharges [m^3/s], spillway capacities [m^3/s], water needed for power production [m^3/kWh]

Methodology

- Development of a Drina Hydro-cascade representation in the model
- Power production from hydropower plants within the Drina River Basin based on:
    - Water availability
    - Rules of operation
    - Environmental flows
    - Storage volumes and discharge rates



Višegrad dam storage levels - 2020-2040

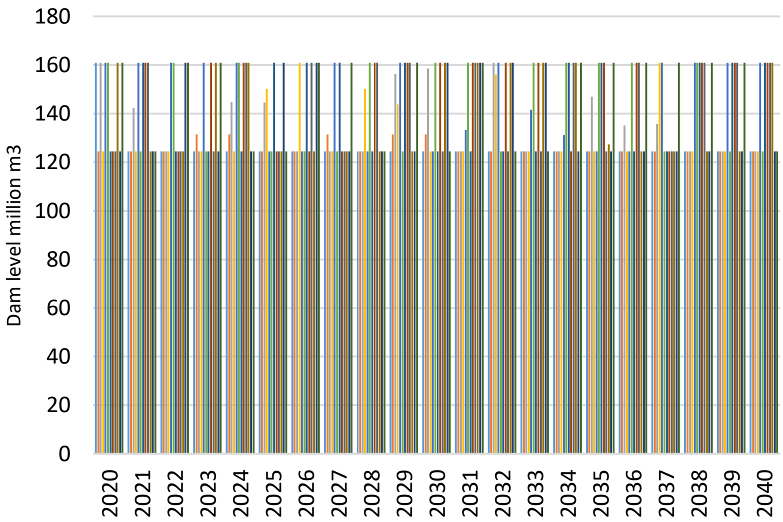


Višegrad dam storage levels - 2020-2040

Obtained calibrations for the period 2020-2040 for HPP Višegrad (yearly averages):

- Yearly discharge of water through the turbines (water used for power production): 8886 MCM/year
- Discharge of water through the spillways: 2025 MCM/year
- Inflow to the dam storage: 10909 MCM/year
- Power production: 1010 GWh

Values regarding environmental flows, operational rules and average flows in the river segments are crucial for the cascade model



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