

Research priorities in hydropeaking

Daniel S. Hayes¹, Maria Cristina Bruno², Maria Alp³, Isabel Boavida⁴, Ramon J. Batalla⁵, Maria Dolores Bejarano⁶, Markus Noack⁷, Davide Vanzo⁸, Roser Casas-Mulet⁹, Damian Vericat^{5,10}, Mauro Caroll¹¹, Diego Tonolla¹², Jo H. Halleraker¹³, Marie-Pierre Gosselin¹⁴, Gabriele Chiogna⁹, Guido Zolezzi¹⁵, Terese E. Venus¹⁶

¹ *University of Natural Resources and Life Sciences, Vienna, Department of Water, Atmosphere and Environment, Institute of Hydrobiology and Aquatic Ecosystem Management, Wien, Austria*

² *Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige, Italy*

³ *RiverLy, INRAE, Villeurbanne, France*

⁴ *CERIS, Instituto Superior Técnico, Universidade de Lisboa, Lisbon, Portugal*

⁵ *Fluvial Dynamics Research Group (RIUS), University of Lleida, Lleida, Spain*

⁶ *Natural Systems and Resources Department, Universidad Politécnica de Madrid, Madrid, Spain*

⁷ *Institute of Applied Research, Karlsruhe University of Applied Science, Karlsruhe, Germany*

⁸ *Laboratory of Hydraulics, Hydrology and Glaciology, ETH Zürich, Zürich, Switzerland*

⁹ *Technical University of Munich, Freising, Germany*

¹⁰ *Forest Sciences and Technology Centre of Catalonia, Solsona, Spain*

¹¹ *Energy Systems, SINTEF Energy Research, Trondheim, Norway*

¹² *Institute of Natural Resource Sciences, Zurich University of Applied Sciences, Wädenswil, Switzerland*

¹³ *Department of Civil and Environmental Engineering, Norwegian University of Science and Technology, Trondheim, Norway*

¹⁴ *Department of Aquatic Ecology, Norwegian Institute for Nature Research, Trondheim, Norway*

¹⁵ *Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy*

¹⁶ *Research Group of Bioeconomy Economics, University of Passau, Passau, Germany*

Email corresponding author: daniel.hayes@boku.ac.at

ABSTRACT: Peak-operating hydropower and hydropeaking have received increasing attention in the last two decades. However, knowledge gaps remain, and the transfer of science into mitigation actions and policy-making is still scarce. In this study, we undertook an online survey available in six languages to gather open research questions from more than 200 hydropeaking experts across the globe. We then used a systematic method of determining expert consensus, the Delphi method, to identify the top 100 key questions out of over 400 submitted ones related to eight thematic fields: (i) hydrology, (ii) physicochemical properties of water, (iii) river morphology and sedimentology, (iv) ecology and biology, (v) socioeconomic topics, (vi) energy markets, (vii) policy and regulation, and (viii) management and mitigation measures. The high-priority questions agreed upon by consensus target research objectives that are both achievable and answerable, covering a broad range of topics. The list of questions thereby serves as a useful tool to direct researchers towards enhancing the science-policy interface, aiming to bolster the sustainability of peak-operating hydropower in diverse geographical and socioeconomic settings.