



Sharing the opportunity cost among power companies to support hydropower-to-environment water transfers

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Among the environmental impacts caused by dams, the alteration of flow regimes is one of the most critical to river ecosystems given its influence in long river reaches and its continuous pattern. Provided it is technically feasible, the reoperation of hydroelectric reservoir systems can, in principle, mitigate the impacts on degraded freshwater ecosystems by recovering some of the natural flow regime. The typical approach to implement hydropower-to-environment water transfers focuses on the reoperation of the dam located immediately upstream of the environmentally sensitive area, meaning that only one power station will bear the brunt of the benefits forgone for the power sector. By ignoring the contribution of upstream infrastructures to the alteration of the flow regime, the opportunity cost associated with the restoration of a flow regime is not equitably distributed among the power companies in the river basin, therefore slowing the establishment of environmental flow programs. Yet, there is no criterion, nor institutional mechanisms, to ensure a fair distribution of the opportunity cost among power stations. This paper addresses this issue by comparing four rules to redistribute the costs faced by the power sector when environmental flows must be implemented in a multireservoir system. The rules are based on the installed capacity of the power plants, the live storage capacity of the reservoirs, the ratio between the incremental flows and the live storage capacity, and the extent of the storage services; that is, the volume of water effectively transferred by each reservoir. The analysis is carried out using the Parana River Basin (Brazil) as a case study.