

Interactive comment on “The water footprint of electricity from hydropower” by M. M. Mekonnen and A. Y. Hoekstra

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As Requested in a previous comment I also believe the concept of water footprint requires further discussion. The authors reference to their own work without acknowledging other concepts for water footprinting, such as suggested in Pfister and Hellweg (2009), Ridoutt and Pfister (2010) and Berger and Finkbeiner (2010). While I think different concepts might be used under the same term, the authors' duty is to make clear which approach is chosen and why. A discussion of these differences is therefore necessary, especially as the impact assessment part suggested by the mentioned papers changes the result considerably and many of highly evaporative hydropower might not be that harmful to ecosystems. Also impact assessment is usually part of a footprint

C4598

measure (compare e.g. carbon footprints) and therefore cosing a different approach needs special explanation in order to inform the reader.

Another point I'd like to have clarified and further discussed is the large amount of the selected hydropower plants' water consumption, which is stated to be 10% of crops irrigation water consumption. As the selected plants represent 8% of the global capacity, a rough upscaling would result equal water consumption of hydropower as of crop irrigation (assuming the other hydropower plants are also highly water consuming). This is very surprising and needs a good discussion and comparison with other recent studies. Some of the concerns of the detailed analysis are raised in the comment by Engeland and obviously attributing all the evaporation losses to power production might be a considerable weakness of the analysis. Anyway, such surprising results should be tested against other publication on the same topic. E.g, a case study for the US revealed evaporation rates on rather detailed level (Torcellini et al. 2003) resulting an average of 25m³/MWh. Another recent study (Pfister et al. 2011), calculated evaporation losses (blue water consumption) of hydropower for each country in the world, based on climatic data. This approach is less detailed but similar and should be compared to evaluate the differences. Pfister et al. (2011) also report water consumption estimates of total global hydropower production to be 65Gm³/yr, which is even lower than for the selected plants in this study (they also discuss the high uncertainty though). As these are remarkable differences they need to be discussed and reasons for the difference evaluated. Also the authors might take this comparison to estimate total global hydropower water consumption based on their analysis.

These suggestions should not require a lot of additional work but I'm convinced integration of these aspects would essentially improve the paper regarding:

- critical evaluation of the approach and results
- estimation of robustness of the results
- providing better understanding to the reader concerning the term "water footprint" in

C4599

the context of current scientific developments.

REFERENCES

Torcellini P, Long N, Judkoff R (2003) Consumptive water use for u.S. Power production. National Renewable Energy Laboratory (NREL), Colorado, United States

Pfister, S.; Saner, D.; Koehler, A.; (2011). The environmental relevance of water consumption in global power production. *International Journal of Life Cycle Assessment*, 16 (6)

Ridoutt BG., and Pfister S. (2010). A revised approach to water footprinting to make transparent the impacts of consumption and production on global freshwater scarcity. *Global Environmental Change*, 20 (1) 113–120.

Pfister S, Hellweg S (2009) The water "Shoesize" Vs. Footprint of bioenergy. *Proceedings of the National Academy of Sciences* 106 (35):E93-E94

Berger M, Finkbeiner M (2010) Water Footprinting: How to Address Water Use in Life Cycle Assessment? *Sustainability* 2 (4):919-944

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