

Integrating water and energy models for policy driven applications. A review of contemporary work and recommendations for future developments

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Abstract-

Availability of and access to water and energy are key ingredients for economic and social development. Unfortunately, more than a billion people still lack access to both safe freshwater and basic energy services. Future predictions show that the situation may become worse with about a 40% increase in energy demand and 30% increase in water demand by 2040. In addition, water and energy are highly interdependent, with water needed in all phases of the energy lifecycle and energy needed in all phases of the water lifecycle. While recent years have seen an increasing number of studies on the water-energy nexus, the research is focused on scattered individual areas of the nexus, each important in their own right. However, there is now a need to synthesize these efforts and identify the most important elements needed for a holistic water-energy nexus methodology. This paper focuses on the benefits to be gained from and the drawbacks of ignoring various water-energy interlinks for policy makers and planners in their goals to meet long term resource security. Several possible combinations of socio-economic and climate change scenarios make these goals even more challenging. The lessons learnt from reviewing different integration methodologies and studies are compiled into a list of key recommendations. It is found that current integration efforts are often biased towards the energy sector and its water requirements. There is still a need for better representations of the water infrastructure and corresponding linkages with the energy sector. There is also a need to harmonize the energy and water systems from both a technical and policy perspective. This calls for compatible disaggregation of spatial and temporal elements in both systems as well as designing model outputs to allow evaluation of the synergies and tradeoffs of multi-scale, cross-sector policies.

Index Terms- Energy; Water; Nexus; Integrated planning

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