

openMASTER: the open source model for the analysis of sustainable energy roadmaps

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Abstract-

Strategic energy planning models play a crucial role in facilitating well-informed decision-making processes for the energy transition. However, the limited accessibility of most energy models has led to the emergence of open-source alternatives, promoting transparency and inclusivity. In this context, this paper presents openMASTER, an open-source version of the Model for the Analysis of Sustainable Energy Roadmaps (MASTER), which has more than a decade-long history in strategic energy planning. openMASTER makes some significant contributions to the existing field of open-source models, including: (i) being the only reviewed open-source model that incorporates all exogenous demand as energy services, (ii) integrating behavioural changes in an endogenous and linear manner, (iii) modelling non-energy raw material consumption and circular economy in the industrial sector, and (iv) being the first open-source model to introduce the technological vintage of end-use technologies. This paper provides a comprehensive overview of openMASTER's structure, equations, and diverse applications, analyzing its contributions and limitations in comparison with similar open-source models from scientific literature. The model's reasonable computational load supports its utility in strategic energy planning. Furthermore, considerable efforts have been dedicated to ensuring accessibility and modularity, with the design of user-friendly data treatment and visualisation modules. In spite of certain limitations of openMASTER for which future research directions are suggested, we believe that it offers an open and innovative platform to drive informed decision-making for a sustainable energy future.

Index Terms- Open-source software; Strategic energy planning; Energy modelling; Energy systems analysis

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