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LEGO: The open-source Low-carbon Expansion Generation Optimization model

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Abstract-

This paper introduces the open-source Low-carbon Expansion Generation Optimization (LEGO) model. It is a multi-purpose tool to carry out numerous techno-economic analyses of the energy sector, ranging from short-term unit commitment to long-term generation and transmission expansion planning. Its highly flexible temporal structure permits both chronological and representative periods. LEGO is composed of thematic blocks that can be combined freely via data options: unit commitment constraints; DC- or AC-OPF formulations; battery degradation; rate of change of frequency inertia constraints; demand-side management; or Power-to-X in the form of the hydrogen sector. This unique feature allows to incorporate highly technical aspects into long-term investment analyses. To our knowledge there is no open-source model that offers this flexibility, which we hereby make freely available to the scientific community.

Index Terms- Energy system planning software; Open-source; Power system optimization; GitHub

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