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A new approach to model load levels in electric power systems with high renewable penetration

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Abstract— In medium- and long-term power system models it is a common approach to approximate the demand curve by load levels in order to make the models computationally tractable. However, in such an approach the chronological information between individual hours is lost. In this paper we propose a novel approach to power system models which constitutes an alternative to the traditional load levels. In particular, we introduce the concept of system states as opposed to load levels, which allows us to better incorporate chronological information in power system models thereby resulting in a more accurate representation of system outcomes such as electricity prices and total cost. Moreover, the system states can be defined taking into account various important system features at once, as opposed to load levels which are defined using just one specific feature, i.e., demand or net demand. Therefore the system states approach
better captures other results such as reserve prices, which are not driven by the usual feature used to define load levels. In a case study we compare the newly proposed methodology to a
standard load level approach, which validates that the system states approach better captures power system outcomes.

Index Terms— Power system models, renewable integration, demand blocks, system states.

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