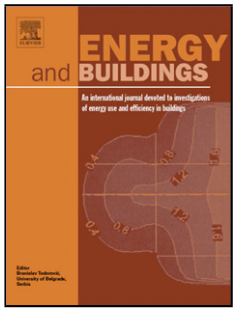

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Modeling the reliability of multi-carrier energy systems considering dynamic behavior of thermal loads

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***Abstract*—** Technological advances in the field of energy conversion have led to the development of multi-carrier energy systems (MCESs). The ability of MCESs to manage different forms of energy can improve the efficiency and reliability of power systems. This paper attempts to address the dynamic behavior of loads in reliability evaluation of MCESs. A Markov-Chain Monte-Carlo approach is employed to model the dynamic behavior of thermal loads. The proposed model also investigates the mutual dependence between different forms of energy and its influence on availability of supply. Numerical simulations of an energy hub are provided to demonstrate the validity of the proposed approach.

Keywords— Reliability; Monte-Carlo; Markov Chain; Multi-Carrier Energy Systems (MCESs); Load Dynamics**.**

Nomenclature

Water Heater Parameters

c	tank thermal capacity (kWh/°C)
T_a	ambient temperature (°C)
$T_T(t)$	water temperature at time t (°C)
T_d	desired temperature for outlet water (°C)
T_{in}	inlet water temperature (°C)
a	thermal resistance of tank walls (kW/°C)

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