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A Dynamic Characterization of Energy Flexibility

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The large penetration rate of renewable energy sources leads to potential challenges in controlling the energy production. This necessitates moving from a paradigm of supply control to demand control for buildings and districts. To do so, a formal and robust characterization for the energy flexibility on the demand side is needed. The most common way to characterize the energy flexibility is by considering it as a static function at every time instant. The validity of this approach is questionable because energy based systems are never at steady-state. To account for this, we characterize the energy flexibility as a dynamic function. The dynamic characterization of energy flexibility allows a natural quantification of flexibility and enables the demand control through penalty signals (e.g. price, CO_2 etc.). Here, a test case study of indoor swimming pools is presented to show the advantages of characterizing the flexibility as a dynamic function over the static description.