



## **Semi-Markov modelling of electricity co-generation in residential applications with time-dependent covariates**

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We analyse electrical energy data produced by micro combined heat and power generators (micro-CHP). They are residential machines which produce heat and electricity simultaneously, controlled by heating requirements. Our goal is to characterize the stochastic process describing the profile of the electricity produced in a typical winter day by a system of micro-CHPs.

As a first ingredient we consider an Accelerated Failure Time (AFT) model with time-varying covariates to describe the time series of the energy produced by a single micro-CHP.

After conducting a Bayesian analysis on this model, we devote the main part of this talk to the analysis of the properties of the sum of many realizations of the estimated process, as a means of evaluating the curve of the electricity fed into the grid by a large number of micro-CHPs. Our approach will be both theoretical and computational.

We will use a Markov chain to simulate the stationary trajectories of an alternating renewal process with time varying covariates, and a variational approach to estimate the quantities of interest. The method will be applied to a real dataset. The data were collected at the Institute of Construction Technology of the Italian National Research Council where a micro CHP system is installed in an experimental building.

**Keywords:** Renewal process; AFT models, Variational inference.