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Novel procedure to formulate load profiles for off-grid rural areas - the Load Pro Gen software

FABIO Riva, MATTEO Moncecchi, MARCO Merlo
Politecnico di Milano
Department of Energy

STEFANO Mandelli
CESI S.p.a

Rural electrification and Load Demand

Load Demand assessments are required in rural electrification especially because **power systems** are often **off-grid**

Rural plants are frequently based on:

- **Renewable Energy Sources [RES] –** Conversion technologies based on these sources are not fully predictable, not-dispatchable
- **Storage systems –** To ensure continuity of the service

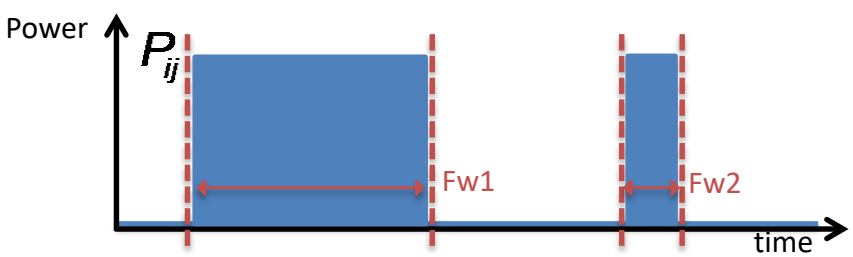
Load Demand estimation → Allows → **optimal sizing of plant and battery**

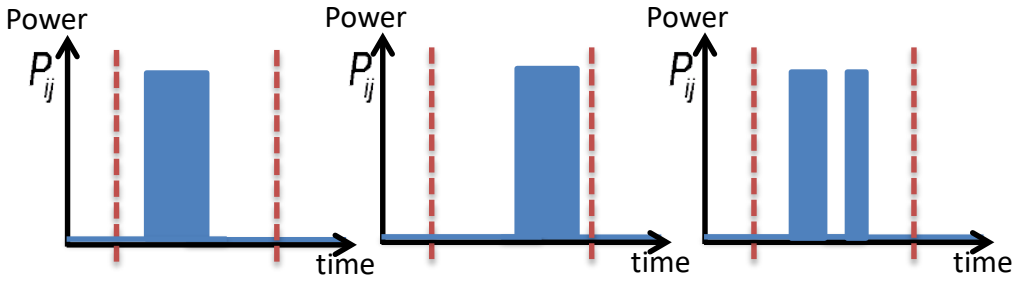
Common approaches

- Profiles are defined without any explanations about their origin (*Bala and Siddique, 2009; Nandi and Ghosh, 2010; Kanase-Patil et al., 2011*).

- Profiles are derived by employing other ones from similar contexts (*Nfah and Ngundam, 2009, 2012; Phrakonkham et al., 2012; Semaoui et al., 2013; Sen and Bhattacharyya, 2014*).

- Profiles are formulated without any defined procedure, but by employing assumptions on electric appliances functioning periods and/or load factors, in order to build up a coincidence behavior (*Al-Karaghouli and Kazmerski, 2010; Gupta et al., 2010; Bekele and Tadesse, 2012*).



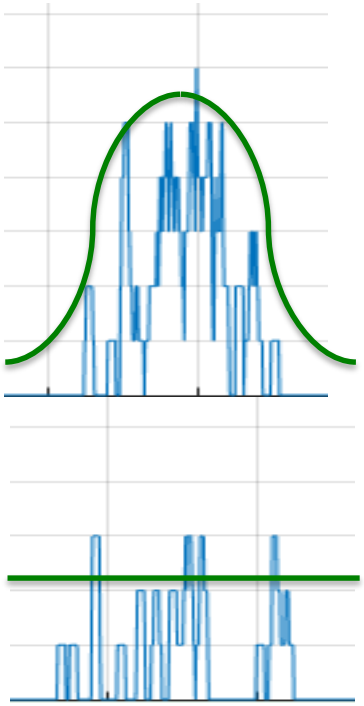


The Load Pro Gen approach

A stochastic method

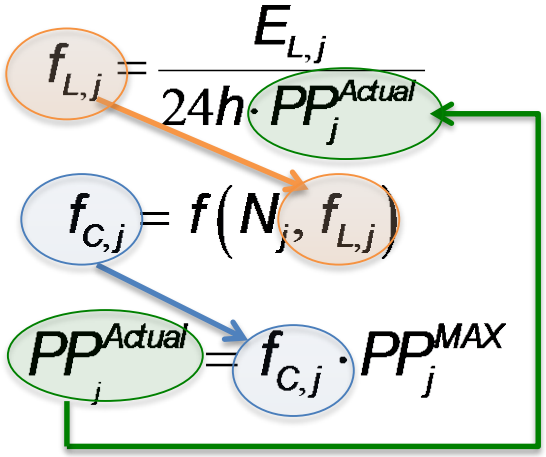
The switching on times are defined with Specific Probability Distribution Functions:

- If the appliance contributes to the power peak
  → Sampling with normal distribution



- If the appliance doesn't contribute to the power peak → Sampling with uniform distribution

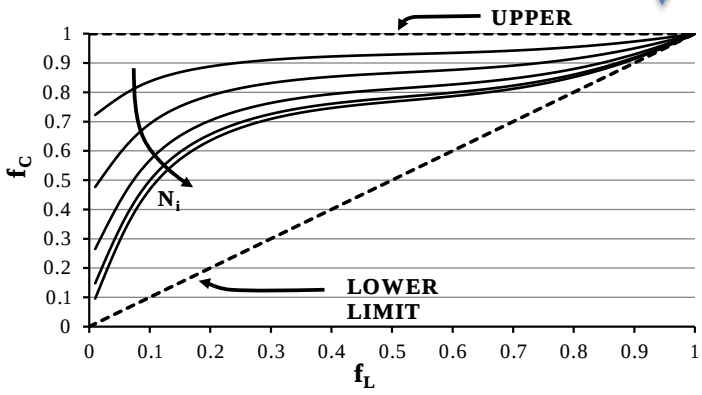
The Load Pro Gen approach

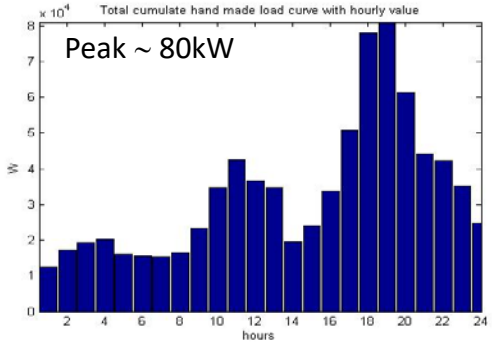


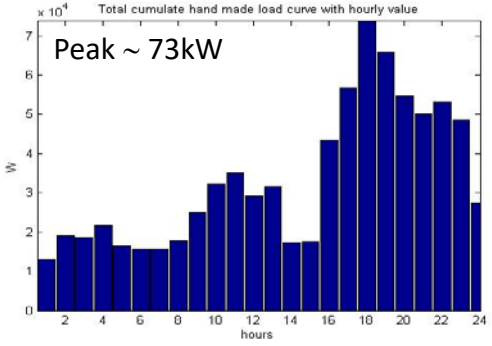
Load factor

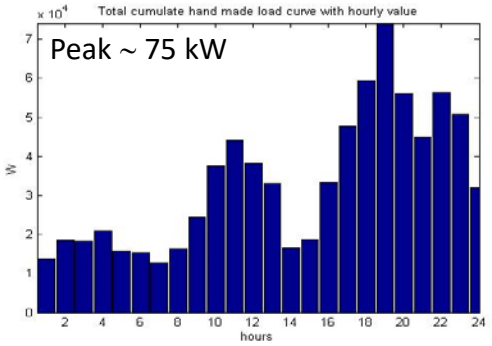
Correlation between load and coincidence factor

Coincidence factor



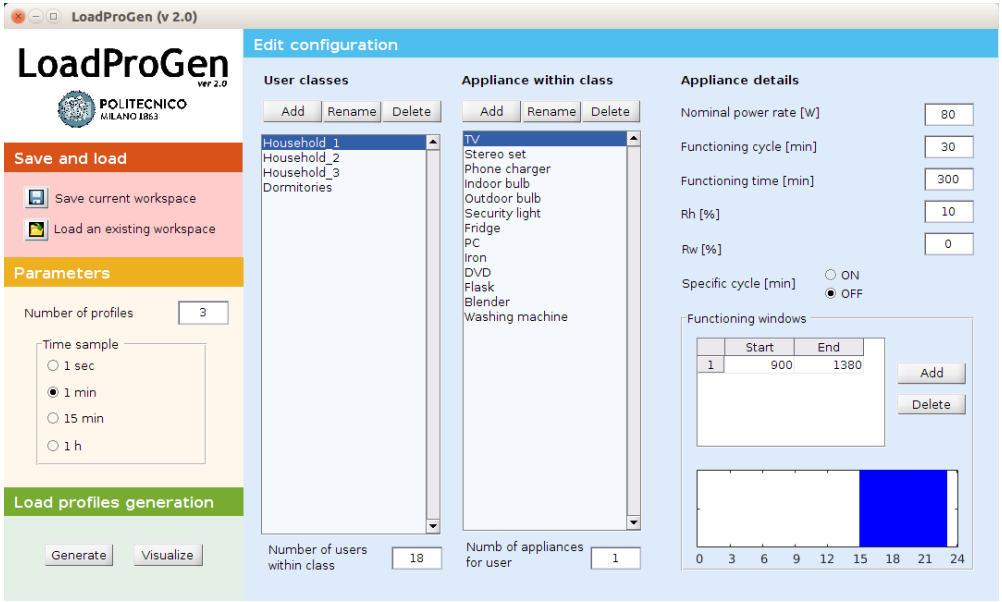






Matlab tool LoadProGen

- With simple inputs seen before it generates the desired numbers of electrical load profiles
- You can use LoadProGen from the command window or the graphical version of the tool

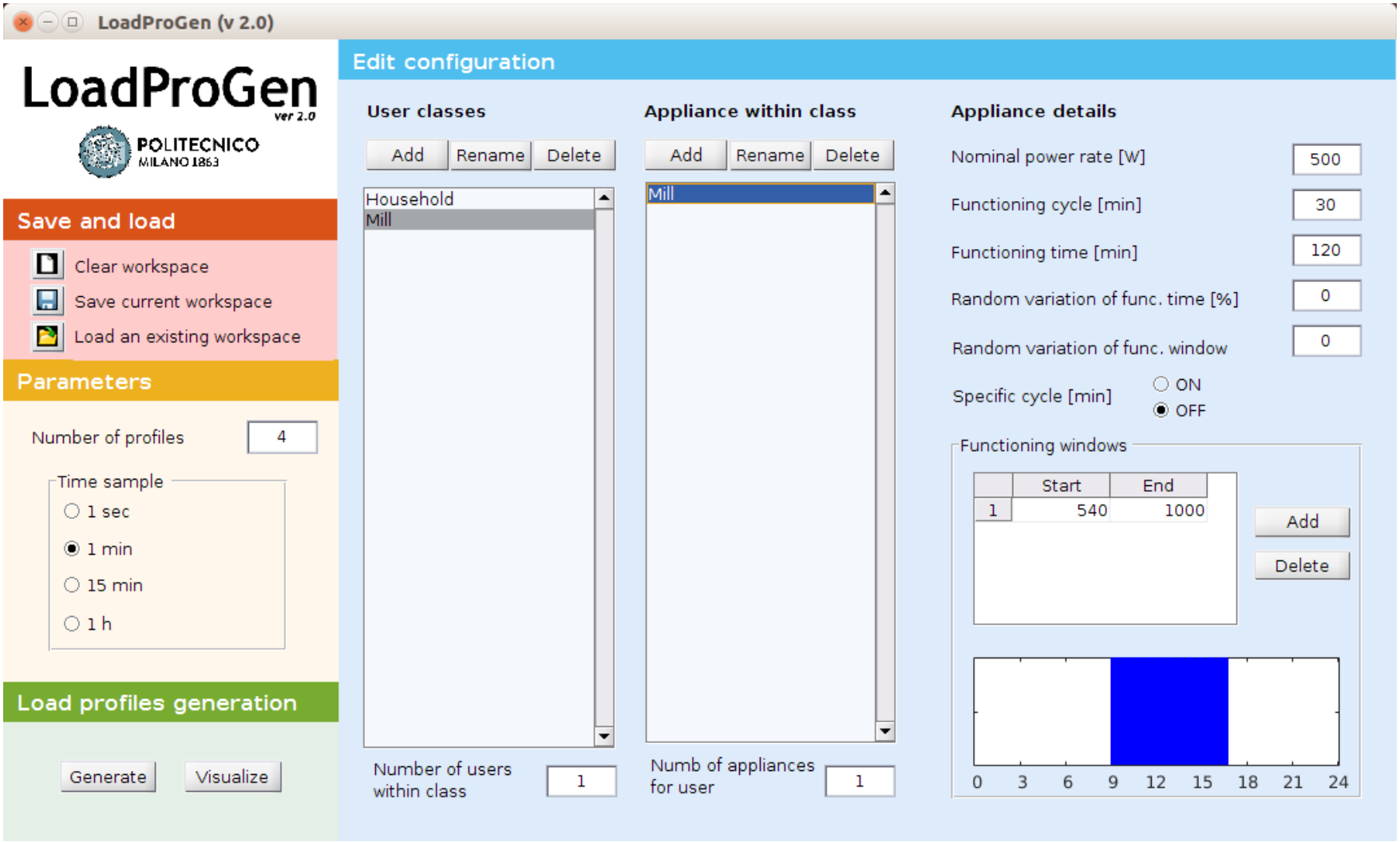


DOWNLOAD: https://it-it.facebook.com/energy4growing2014/

PUBLICATION: Stefano Mandelli, Marco Merlo, and Emanuela Colombo. "Novel procedure to formulate load profiles for off-grid rural areas." *Energy for Sustainable Development* 31 (2016): 130-142.

Matlab tool LoadProGen - Examples

- Lights, fridge and mill



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