Politecnico di Torino
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PhD in Computer and Control Engineering
XXXV cycle

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# Distributed platform for multi-model co-simulation in smart grids

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## 1. Introduction and Objectives

The Smart Grid is complex system where different entities cooperate by exchanging information and energy. In this view Metering Infrastructure and Renewable Energy Sources (RES) are two that will play an important role, thus the necessity to analyze their potentiality. The objective of the research is to develop models of smart-meters and RES for co-simulations .

## 2. Methods and results

### 2.1 3-Phase Smart Metering Infrastructure

The work [1] proposes a 3-Phase smart meter prototype with a IOT communication infrastructure that enables the self configuration and the auto-update of the device. The smart meter is capable or running non-trivial algorithm for the grid management. The overall system enables a self-healing grid capable of restoring the service in a fraction of the time w.r.t. the actual solution. The test were performed using: i) Hardware In the Loop (HIL) with a Real Time Simulator (RTS), ii) network congestion simulator for the communication.

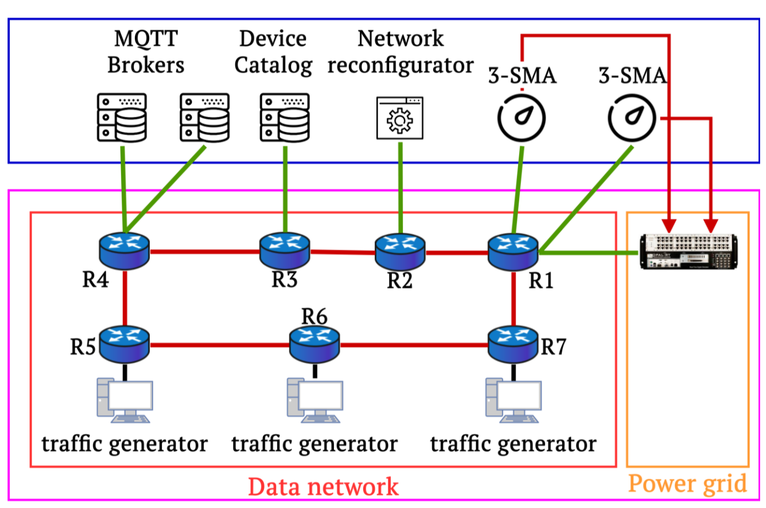


*Fig 1. 3SMA testing architecture*

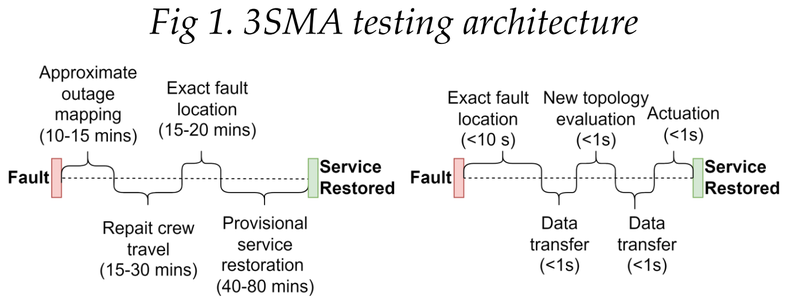


*Fig 2. Traditional vs proposed outage management*

### 2.1 Prosumer and Renewable Energy Community (REC)

PV systems are the most common RES used by those new actors that are entering the energy market such as prosumer and REC. Therefore, we propose a framework to assist them in the planning of their own PV system. This framework use GIS and weather data to estimate the solar irradiance over the roof. Then it provides and optimal placement for the module pf the PV system to maximize the power production (w.r.t. traditional installation). This analysis can be performed for a single roof (prosumer [2]) or for a wider area (REC [3]). In both cases an economic analysis is performed to identify the best tradeoff between cost and benefit of the system.

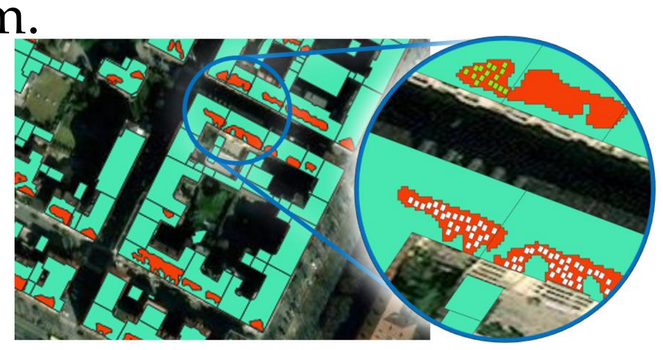

*Fig 3. Optimal cross-roof PV placement*

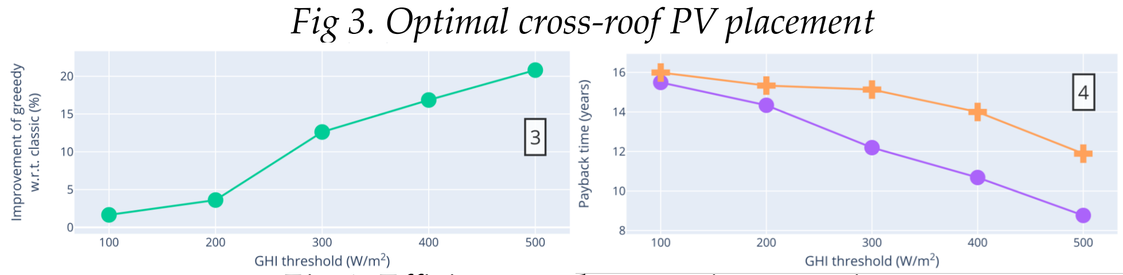


*Fig 4. Efficiency and economic comparison*

## 3. Conclusion

Both the contribution show promising result and they are ready to be used in the analysis of complex Smart Grid scenarios through co-simulations

## 4. References

[1] M. Orlando *et al.*, "A Smart Meter Infrastructure for Smart Grid IoT Applications," in IEEE Internet of Things Journal, 15 July 2022.

[2] M. Orlando *et al.*, "Optimal Configuration and Placement of PV Systems in Building Roofs with Cost Analysis," 2020 COMPSAC.

[3] M. Orlando *et al.*, "Design of District-level Photovoltaic Installations for Optimal Power Production and Economic Benefit," 2021 COMPSAC.