

Contribution ID: 25

Type: **not specified**

Digital Twin of energy, water and material consumption in Instituto Superior Técnico

Thursday 9 February 2023 15:05 (15 minutes)

Rising electricity prices, high dependencies on imported energy and increasing concerns with sustainability are all driving forces advocating for a larger adoption of renewable resources in the power grid. However, this inclusion is not without its challenges, since there is a need to meet a changing electricity demand with an intermittent energy source, requiring the development of a strong and robust online analysis tool. Furthermore, nowadays' moving trend of decentralization and automatization of processes has imposed a growing pressure to digitalize service grids, with particular interest being taken on the creation of digital twins of the power grid. The latter would include a virtual counterpart of the physical entity, which would be fueled with a continuous stream of data acquired through sensors, as to mirror the grid's behaviors and characteristics to the best extent possible. A virtual element with such features could easily and faithfully simulate the grid's response in any number of scenarios, in near real-time and with little risks and associated costs. Besides optimizing the grid's operation, if forecast data of electricity demand and production is included, digital twins become the best solution to support a safe and reliable integration of renewable resources. Moreover, with the right sensory devices, a digital twin would allow us to monitor and control the grid, perform active diagnosis and conduct predictive maintenance.

The goal of this thesis is to bring all of the aforesaid services into Instituto Superior Técnico by creating a digital twin of the energy, water and material consumption, greatly supporting decision making activities. Furthermore, the DT can provide meaningful insights as for the integration of solar panels and batteries, which are planned to be included in the campus.

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