information between nodes located in separate geographic locations. More specifically, the virtual laboratory enabled researchers to:

- Share information by adopting the publish-subscribe messaging model, which is especially adequate when multiple consumers need to access data as it is produced with minimal latency.
- Visualise information that is kept in a time series database for long-term storage. There is a service that automatically communicates with the messaging broker in order to interconnect both services, that is, the messaging broker acts as a data source while the time series database acts as a data sink. The dashboard application provides users with the ability to build ad-hoc visualisations using advanced Web components.
- Query the time series database API to retrieve and process historical information. For example, users can download datasets serialised in CSV format, which are automatically aggregated in the server depending on the requested resolution.
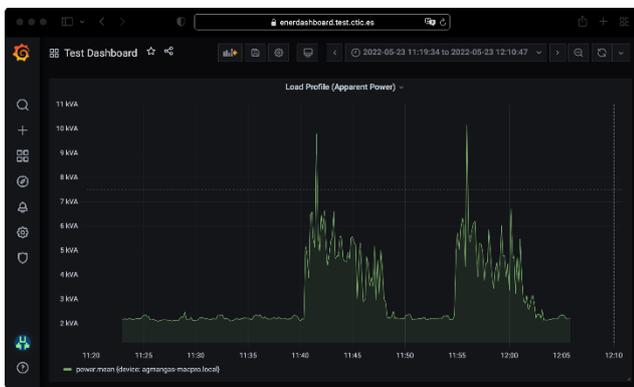

Fig. 7. Screen-shoot of the information uploaded to the platform along tests.

4.Conclusion

Due to the increasing penetration of intermittent and random renewable energies, microgrids management algorithms become crucial for the electric system of the future. These algorithms have to be tested in real environments, in real facilities, or as close to the real world as possible, laboratories. This is very difficult in many cases, especially in the initial stages of the development of these control systems. As a potential solution, this article proposes the use of a virtual laboratory, with a behaviour similar to that of real installations. With this objective in mind, a virtual laboratory for the development, testing and debugging of tools for the management of microgrids has been presented in this document. The proposed strategy is considered safe and efficient for the proposed objectives.

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