

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Alvaro Gonzalez

PhD Program: Engineering Systems

Title of Thesis: Flexibility characterization in power systems

Supervisor: Assistant Professor Aldo Bischi, Skoltech

Co-supervisor: Assistant Professor David Pozo, Skoltech

Name of the Reviewer: Full Professor Janusz Bialek, Skoltech

I confirm the absence of any conflict of interest	
Janusz Bialek	Date: 15-09-2021

The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The thesis addresses a very topical problem of power system flexibility, in both technical and economic sense, which is of increasing importance as renewable generation increases its penetration in many countries around the world. Specifically, it develops a novel convex mathematical model for electric energy storage unit's operation, it proposes a market for heat exchange between integrated heat-and power Microgrids, with a convex decomposable structure, making it suitable for decentralized microgrids' coordination and dual pricing derivation. And finally, it generalizes the existing chance-constrained energy and reserves market designs to include the modeling of asymmetric forecast errors of renewable generation. It assesses that the contributions are at the cutting edge of international research. They are also of potentially practical significance as they should help reduce the cost of achieving renewable energy targets.

The thesis is clearly written outlining original contributions to knowledge. The material is presented in a logical and structured way giving a comprehensive characterization of flexibility in power systems. The overall quality of the thesis is excellent and is comparable to best PhD dissertations in best British universities.

The research has resulted in publications of two first-authored articles in first-class journals (with further two submitted), 1 book chapter and 15 refereed conference papers. This is an excellent result.

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense

I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes would be introduced in candidate's thesis according to the recommendations of the present report

The thesis is not acceptable and I recommend that the candidate be exempt from the formal thesis defense