

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Tatiana Chernova

PhD Program: Engineering Systems

Title of Thesis: Specific aspects of peer-to-peer energy market design and operation

Supervisor: Assistant Professor Elena Gryazina, Skoltech

Name of the Reviewer: DIPTI SAXENA

I confirm the absence of any conflict of interest

(Alternatively, Reviewer can formulate a possible conflict)

Date: 01-11-2024

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

In this PhD. thesis work, the scholar has developed two optimization-based P2P market design schemes tailored for meshed and radial networks, ensuring compliance with network constraints and market outcomes. By immediately integrating feasibility tests into the market structure, the scholar's method removes the need for system operators to take corrective action. By modifying trade prices to account for user preferences, the researcher also presents a universal regularization technique that influences trade patterns by incorporating user preferences such as generation type, CO₂ footprint, and distance. The researcher has also taken into consideration network fees to help maintain the grid and studied the effects of energy storage devices and agent preferences together on market behavior, pointing out areas that require improvement under specific cost structures. The researcher also suggests a risk-aware market architecture called zeta-eta, which manages renewable energy uncertainty by utilizing chance restrictions to lower dispatch costs and avoid line overloads. This architecture is flexible enough to work with both radial and mesh networks.

The results are convincing and may certainly help researchers interested in this field to boost their efforts and to go for further investigations. Bibliographical references are very rich and enough diversified. The results obtained from this work have been published in peer-reviewed journals and International conferences. I recommend/advise, if the scholar can summarize his work in the form of a comprehensive report/article and try to get it published with a Journal of repute (IEEE/Nature, etc.). Lastly, the research scholar concluded the work in a nice manner and predicted important tasks that could be taken up in the future in this area. It is advisable that she may also elaborate few other methods and applications during her interaction with the viva-voce evaluation committee, that are useful to extend this work for achieving the same outcomes or better techniques covering other important issues.

Suggestion to the candidate for improvement of the thesis

1. The scholar should cite reference, along with the figure title, if the figure is taken from some literature, for example, cite the reference in Figure 1-1.
2. The full form of the abbreviations is not uniform throughout the thesis. The scholar is advised to make it uniform, either "Capitalize each word" or "Sentence Case."
3. The research scholar may avoid capitalizing words in the middle of sentences for example, "Thesis" should be replaced by "thesis" if it is in the middle of a sentence. The same correction may be done for other words throughout the thesis.
4. The scholar should use subsections for example in section 5.4, different headings can correspond to different subsections, similarly for subsection 2.2.7 it should be done.
5. Correct the inverted comma, punctuation section 3.1.1, second and third line

Queries, Questions, and points to be responded by the candidate at the time of Viva-voce

1. In the proposed optimization-based P2P market schemes, how do user preferences (like generation type and CO₂ footprint) affect trading patterns?
2. How does the presence of energy storage systems impact the operation of P2P markets?
3. Why is managing uncertainty important in P2P energy markets, especially with renewable energy sources?
4. How does the stability of the P2P market get affected by energy storage systems and agent preferences, and how may market reformulations help with these issues?

Provisional Recommendation

*I recommend that the candidate should defend the thesis by means of a formal thesis defense only after appropriate changes mentioned in “**Suggestion to the candidate for improvement of the thesis**” would be introduced in candidate’s thesis according to the recommendations of the present report.*

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