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Analysis of the dynamic power requirements for controllable energy storage on photovoltaic microgrid

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2016

http://hdl.handle.net/10539/22674

Horonga, Nyasha (2016) Analysis of the dynamic power requirements for controllable energy storage on photovoltaic microgrid, University of the Witwatersrand, Johannesburg, <http://hdl.handle.net/10539/22674>

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31 August 2016

Dear Prof W. A. Cronje and Prof Fambirai Takawira,

RE: RESPONSES TO MY MSc DISSERTATION EXAMINERS' COMMENTS

Please receive the accompanying response report to the comments made by the internal and external examiners on my master's dissertation, topic: ***"Analysis of the dynamic power requirements for controllable energy storage on photovoltaic microgrid"***.

I am pleased that both the examiners accepted the dissertation for Master's level, with condition that revisions based on their feedback are made. The revised dissertation should be to the satisfaction of the supervisor and the head of school.

I responded to each examiner's feedback/comments individually, in the attached response report.

Yours faithfully,

Nyasha Horonga

Examiner 1

Examiner's comment:
Abstract: Conventionally written as one paragraph, not separate paragraphs with inconsistent spacing. It may also be worth introducing terms ramp rate and delay time and what they mean in the context of the research.

Response:

The abstract has been written as one paragraph and the terms ramp rate and delay time have been defined in the "Important Definitions" section at the beginning of the dissertation.

Examiner's comment:
P.xi (Table of Contents): Figure 5.2 is followed by Figure 3,4,5,…… I suspect this should be Figure A3, A4, etc. Additionally, it should be "University of the Witwatersrand"

Response:
Appendix numbering was corrected. "university of the Witwatersrand" was changed to "University of the Witwatersrand".

Examiner's comment:
P.xii (Important definitions): Only two definitions are supplied. Either drop this section, or include all the important terms, inter alia, ramp rate, delay time, load profile,……

Response:
Additional important definitions have been included. These terms include; ramp rate, delay time.

Examiner's comment:
P.2. Text truncated in figure axis.
Response:
This has been corrected by adjusting the figure position.

Examiner's comment:
P.6. "Sizing of the energy storage has been addressed by many authors…." – this statement needs to be supported by citing an appropriate reference.

Response:
References to support the statement have been added to the reference list.

Examiner's comment:
P.8. "Agilent" should have a capital letter. Recommend citing the user manual for the device.
Response:
"agilent" changed to "Agilent". The user manual for the device has been referenced.

Examiner's comment:
P.11. "The research focuses mainly on energy storage systems as these have has been identified as …" – In illustrative example of the pervasive grammatical and typological problems in the document.

Response:
The sentence has been rephrased.

Examiner's comment:
P.14: This page contains no fewer than 8 citations to the same reference ([12]) – This is stylistically weak and of concern. In addition, I am unable to find any indication in the reference to support the statement "The rated output of the microgrid is 4.803kWh".

Response:
More supporting references have been added and a reference that clearly support the statement mentioned by the examiner has been added to the reference list.

Examiner's comment:
P.15: Another three citations to reference [12] (see previous point). The statement "The technical details on the ramp rate requirements was not fully addressed on the documents available to the author." Is stylistically and grammatically problematic.

Response:
The statement has been rephrased to "The technical details on the ramp rate requirements were not fully addressed in the currently available literature."

Examiner's comment:
P.22: Please explain why the "Batteries" box is at an angle in Figure 2.1.

Response:
The figure was used as to give a rough idea of the energy storage technologies energy and power capabilities. The "batteries" box has been adjusted for consistency.

Examiner's comment:
P.26: whilst there is no problem referring to the papers included as an appendix to the dissertation, I would strongly recommend that formal citations are made to the work and included in the Reference section of the document.

Response:

Formal citations have been made to the work and included in the Reference section.

Examiner's comment:

P.27: numerous grammatical issues at the top of the page. Also should be "Chamber of Mines building".

Response:

The grammatical issues have been addressed and "Chamber of mines building" has been changed to "Chamber of Mines building".

Examiner's comment:

P.28: in Figure 3.2 where measurements are presented for a 48-hour period, highlighting the fact that the data was sampled at 40ms intervals makes little sense given the lack of resolution.

Response:

Because the research was mainly focusing on how fast insolation and load demand change, It is important mention the rate at which the data was sampled.

Examiner's comment:

P.32: the phrase "It is important to note" is a stock phrase and adds little or no value.

Response:

The phrase has been removed.

Examiner's comment:

P.40: "By increasing load diversity the author mean increasing the number ….." Stylistically and grammatically flawed.

Response:

The sentence has been rephrased to" Increasing load diversity in this context means increasing the number of load with different dynamics and different initial transients. This will result in reduced overall load dynamics."

Examiner's comment:

Pp. 43 – 70: Chapter 4 is arguably too broad and all inclusive. It may be worth considering breaking into two or three better focused chapters.

Response:

Chapter 4 was split into two chapters as recommended by the examiner: Microgrid simulations and Discussion of Simulation Results.

Examiner's comment:

P.63: "Figure also shows that the energy storage system ramp rate …" – missing figure number. What does the word "smoothening" mean?

Response:

The figure number has been included. The word smoothening will be included on the list of important definitions.

Examiner's comment:

P.69: Given only the figure and caption, it is not all clear what the difference between the four subfigures is. The caption must be improved.

Response:

The caption has been improved.

Examiner's comment:

P.71: "At this stage, A computer …." – no need for the capital letter. This style typographic error appears at numerous points in the dissertation. (See P.75 for another example).

Response:

These style typographic errors have been corrected.

Examiner's comment:

P.77: Recommend that the size of Figure 5.2 be increased.

Response:

The size of Figure 5.2 has been increased as recommended by the examiner.

Examiner's comment:

Pp 78 – 82 (References): Please thoroughly check each and every reference. There are typographical errors as well as problematic references. By means of example, [2] should be "Africa". The link in [3] does not work. Why are there initials before and after the surname in [8]? There appears to be a missing name in [15]. Should it not be M. Garcia in [18] and [19]? Should be PV in [22]. As discussed earlier, include references to the conferences papers included in Appendix C.

Response:

The typographical errors have been corrected and the conference papers in Appendix C have been added to the references list.

Examiner's comment:

Pp. 83 – 101 (Appendices). Appendices should be self-standing documents, in other words, they should at the very least include an introduction. Appendix A needs an introduction and conclusion. Appendix B needs at least an introduction.

Response:

Introductions have been added in Appendix A and Appendix B. A conclusion has been added to Appendix A as recommended by the examiner.

Examiner's comment:

Pp. 83 – 103: The section numbering in the appendices is flawed. Mr. Horonga must consult the documentation for the typesetting package he used in order to correct this. It should be "A.1 Data measurements" and not ".1 Data measurements".

Response:

The numbering in the Appendices has been corrected as requested by the examiner.

Examiner's comment

P.102: it is important to indicate when and where these publications were published, or if they were simply submitted for review, and not published, etc.

Response:

Details of the publications recommended by the examiner have been added in Appendix C introduction.

Examiner 2

Examiner's comment:

Abstract: The problem and objectives are not provided and too much emphasis is placed on the actual results.

Response:

Problem and objectives of the research have been added to the abstract.

Examiner's comment:

There are numerous grammatical mistakes and sentence structure mistakes.

Response:

The report has been proof-read to minimize these grammatical errors.

Examiner's comment:

The scope of the research is very limited and the problem really oversimplified in terms of a single phase DC problem with only resistive impedances and no reactive power.

Response:

The research focused on a 3 phase balanced system and not a single phase DC as stated by the examiner. Resistive load was used in the research because most domestic appliances have a power factor of more than 0.5. This means that the reactive power ramp rate will in most cases be lower than the real power ramp rate. It is for this reason; real power was used as a proxy for active power in the system. The author however acknowledges that research into the reactive power ramp rate may be required in future and this work forms part of the future recommendations.

Examiner's comment:

The candidate could have given a better background in terms of the actual system configuration within the three phase context with the actual location of the storage element. It is not clear whether the energy storage is on the DC side or on the AC side.

Response:

As part of the important definitions, the author explained what an Energy Storage System ESS meant. The definition explained that ESS was a combination of the energy storage technology and the three phase inverter. Figure 4.2 further showed that the ESS was connected to a three phase power network. Figure 4.6 showed the actual system configuration within the three phase context.