CTU
CZECH TECHNICAL UNIVERSITY IN PRAGUE

THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Residential building power supply with renewable energy sources**
Author's name:	**Anton Makarov**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Economics, Management and Humanities
Thesis reviewer:	František Macholda
Reviewer's department:	External

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment **ordinarily challenging**

How demanding was the assigned project?

The assignment was average – to assess a model situation of an island energy system.

Fulfilment of assignment **fulfilled with major objections**

How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.

The assignment defined as the items of the Guidelines was formally fulfilled. All the items have their reflection in the text of the thesis.

The problem is in the practical value of the work and their conclusions. The author did not correctly understand the problem of the island system and its solutions in terms of a common sense.

The first step should be to minimize the energy demands of the building. The author based his assumptions on paper published in 2007. This paper (probably) provided guidelines for electrical wiring design but the values of power inputs are far away from the current energy efficient standards. The nominal power of lighting in hundreds to thousands W in each room (2,2 kW in the living room!) is not usual even for common households, the computer in each room with the nominal power of 1 kW, stereo system with 0,7 kW, etc. are oversized significantly.

Why is the building air conditioned? The building prepared for island energy system should be built in passive standard that means no artificial cooling would be necessary.

Why does the author suppose the electric fireplace and Jacuzzi? These items are not necessary in the situation of the energy shortage.

On the other hand, the heating system of 3,6 kW (+2 kW electric fireplace) would be probably not enough for the building of total area of 150 m2 during the winter peak frost (-30 °C in Tomsk). Beside this, no heat sources are installed in the kitchen, bathrooms, and the living room is equipped with the electric fireplace only. There is no information about the heating he building except the floor heating.

The model does not count with necessity of water pumps, ventilation, etc.

If the model were to work, it would have to be built completely differently. The heating system could be based on an automatic energy system different from electricity, for example wooden pellets boiler. All the unnecessary items (air-conditioning, Jacuzzi...) should be cut out. The water heating could be based on the solar thermal system combined with boiler. All the lighting could be cut to 1 - 3 % of the listed power using LED sources. Energy demands of the IT are 90 % lower in 21. century than the listed values.

The incorrect inputs lead to incorrect outputs. The conclusions of the whole work were very different if the author would think about the real parameters of the model house.

Methodology **partially applicable**

Comment on the correctness of the approach and/or the solution methods.

A methodology of the thesis consists of several parts: A baseline model definition (incorrect), solar gains calculation (mostly correct), wind power production (mostly correct), total energy balance (incorrect), economic analysis (correct), sensitivity analysis (mostly correct), final decision (formally correct, practically wrong).

The incorrectness of the baseline model was described above.

The solar energy production depends on more parameters. The author should optimize at least a tilt and orientation of the

solar system with respect to the energy needs in the most exposed period of a year. Regarding the wind energy, the average monthly wind speed is not the correct criterion because the wind turbine stops working when the wind speed is lower or higher than specific values. A wind speed distribution should be taken into consideration as well. The result could be different and may affect the overall energy production significantly because the production depends on the third power of the average speed of the wind. The Table 8 does not correspond with the following graph Fig. 14. The table shows the operational wind speed 3 – 20 m/s with nominal power at 9 m/s whilst the graph shows maximum active power at 7,5 m/s and the axis ends at 10 m/s.
The total energy balance is wrong because no significant differences of the energy needs or consumption are visible during the whole year. The author did not take the external temperatures etc. during the year into account. The energy balance is based on non-specified hourly coefficients only.
The economic analysis is generally correct as well as the sensitivity analysis. The sensitivity analysis deals with parameters like interest rate and discount rate but the dependency of NPV on the total energy needs and associated investment costs would be more interesting. The final decision is based on the inputs see the comments above.

Technical level **F - failed.**

Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?

The thesis is wrong in most technical inputs. The details of the energy production are not so important. The main problem is the overall energy balance of the building that is completely wrong. The author has no idea about the power consumption of common appliances as lighting sources, computers, etc. He used very obsolete sources of information and did not check them with his common sense. The issue of heating the house is not commented at all even if it is the main item of the energy balance. The daily balance is described although it is not so important due to batteries but the yearly balance is not commented in terms of needs of lighting, heating and availability of renewable energy for several subsequent days during the most critical period of a year. The energy needs could be very different in terms of heating (and possible cooling) at the place where external temperatures may vary in the range of -30 - +35 °C.

Formal and language level, scope of thesis **C - good.**

Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?

The formal look of the thesis is good. The language is understandable. The presentation is not very professional because the author uses a first person and speaks to audience as in general conversation. A research paper should be written in passive voice. ("The picture shows" instead of "I would like to show").

Selection of sources, citation correctness **F - failed.**

Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?

Parts of the text are taken literally from the internet. They are quoted as information sources but if the longer text is copied, it should be marked with quotation marks. It is unacceptable to copy longer paragraphs of a text. The whole chapter 1 is copied from Internet. Examples: Wind energy – copied from https://www.irena.org/wind, 1. Review of the current condition in the field of renewables – copied from https://vipo.iea.org/topics/renewables/, Solar energy – copied from https://www.irena.org/solar. The texts based on Cyrillic were not checked.

The quoted information sources are mostly Russian and some of them are obsolete. The author should search for relevant information sources across the most important scientific and technical literature and to pick the most relevant pieces instead of choosing the most comfortable way.

Additional commentary and evaluation (optional)

Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.

The author demonstrated satisfactory knowledge of the economic analysis but failed in technical issues and use of common sense. The formal aspects of the thesis are acceptable. The long parts of the text are copied from Internet (the whole

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chapter 1). The thesis is unacceptable because of plagiarism.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Summarize your opinion on the thesis and explain your final grading. Pose questions that shc *nswered during the presentation and defense of the student's work.*

The grade that I award for the thesis is **F - failed.**

Date: **10.6.2020**

Signature: