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 minor 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 author improved his work in comparison with the last version in a part describing energy demand. Assumed power needs for building systems are much more relevant. On the other hand, following considerations are not correct in some parts. The energy balance on the consumption side should be more explained.

For example:

The power input of the stove is 8 kW. The monthly consumption of the stove is (according to the author) 238,7 kWh, i.e. 7,7 kWh daily. It is very improbable that all four hobs and an oven would be in operation for almost one hour every day (max. power input of the stove). As a rule of thumb, a very rough estimation of energy consumption estimation states a need of 0,15 kWh per one meal in the average household. For 4 persons in the household and 3 meals a day, the monthly consumption should be about 54 kWh / month.

The consumption of an average washing machine is about 1 kWh per cycle. A standard methodology counts with 220 cycles per year, so average monthly consumption should be around 18 kWh per month while the author counts with 62 – 68 kWh. It is not usual to wash the clothes several times a day.

The electric parts of the boiler for heating the space have power input of 0,15 kW. According the consumption listed, the heating system is in operation 6,6 hrs per day in the hottest part of a year – why?

The most mysterious secret is the consumption of power sockets – 15 kWh monthly. All the possible regularly used appliances are listed in the table, the socket consumption is additional, and they could be used for charging of mobile phone or similar small usage. The author probably (and incorrectly) estimated the consumption on a base of their potential power input.

It is not very likely that the kettle would be in operation 45 minutes a day. An 1,5 kW kettle needs about 5 minutes to boil 1 l of water. Nobody can drink 9 l of tea every day…

The other parts of the energy balance are overestimated as well.

This means that the input power of appliances is mostly correctly listed; the power consumption is very significantly overestimated. This error leads to wrong estimates of an energy production capacity required and finally to much higher investment costs.

The second point is author's misunderstanding of renewable energy sources "behavior". A design of battery capacity for 24 h operation is wrong in case of wind turbine and solar system combination. The author could not imagine a situation when in the middle of winter (almost no sunshine but a space heating is crucial) wind stops blowing for 3 days (very possible situation). The design of the batteries of the same capacity for all the variants is not reasonable.

Despite these errors, the following chapters are acceptable. The author provided an analysis of NPV for 8 options and a sensitivity analysis for a discount rate, an interest rate and for a fuel price escalation. Then, he produced a final decision using the Global criterion method.

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 (mostly correct), solar gains calculation (correct), wind power production (mostly correct), total energy balance (rather incorrect), economic analysis (correct), sensitivity analysis (correct), final decision (partially correct). The misunderstanding of the energy balance leads significant increase of the investment costs. As a consequence, the final results could be wrong as well as the final decision. One more question arises in this chapter: Why the re-investment to the batteries is paid by investor´s own money instead of loan in variants with a loan? The methodology should be consistent even in this point.	

Technical level	**D - satisfactory.**
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 author claims that he would like to buy a cottage similar to the model case. He should be very careful with his estimations and make his decisions about energy supply after much precise analysis then he provided in his thesis. The proposed solution could place an unnecessary financial burden on him for many years.	

Formal and language level, scope of thesis	**D - satisfactory.**
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"). Numbers in tables are rounded to a different number of decimal places. Numbers like 691,53669 kWh just beside 93 kWh in the same table are not an example of good writing skills.	

Selection of sources, citation correctness	**C - good.**
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?	
Citations are generally correct. A diploma thesis should contain more sources based on books or papers published in science journals than on commercial product specifications etc. More essential sources should be taken into account. Some items are not easily understandable, for example: Appendix 5 – Hour coefficient for winter and summer season [19] – what coefficient is it?	

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 still needs to improve practical engineering judgement. The formal aspects of the thesis are acceptable.

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 should be answered during the presentation and defense of the student's work.

The grade that I award for the thesis is **D - satisfactory.**

Date: **15.1.2021** Signature: