

Review by opponent of the Diploma thesis

Topic: **Assessment of effectiveness the use of solar panels**

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Opponent: **Jan Gerstberger**

Thesis is covering problems of electricity supply to consumers in distant regions of Russia using combination of the diesel power station and PV power plant. Author described the technical part of decentralized electricity supply in the first part of his thesis and proposed methodology of economic evaluation with basic economic calculations in the other part.

In my opinion, instructions present in thesis specification sheet (Zadání diplomové práce) have been fulfilled.

There are a few formal shortcomings in the thesis associated with mixed Russian and English languages usually in graphs, charts and tables (for example: Figure 23 on page 35; Table 11, 12 on pages 40, 41; Figure 24, 25 on pages 42,43) Thesis language is English and there should be no abbreviations in Russian language (such as “p.” for rubles).

There is a mistake in formula of CF calculation on the page 38, but in the excel spreadsheet CF is calculated correctly, so I take it only as a typo.

The main things I miss in the thesis are precisely specified assumptions, discussion of the economy model inputs (such as price of technology) and more detailed technical specification of used components.

All prices are in rubles, it seems to be correct in the case of diesel generators CAPEX and in the labour cost. PV panels and inverters proposed in thesis are Chinese products, so basic prices should be probably in USD or CNY with assumed exchange rate.

In my opinion the prices of the PV technology used in the thesis are a bit high. If it is caused by import duties, it has not been mentioned in the thesis.

In the thesis there is specification of used engines by type and nominal power. I miss the names of the diesel generator manufacturers and especially performance curves (especially consumption rate curve) I don't know how the diesel fuel consumption and diesel fuel savings has been calculated without consumption curve, although the numbers seems reasonable.

I miss description of the method used for choose of the diesel generators. Neither the total installed power nor assembly of the installed power from the particular generators.

The oil price seems a bit high to me. As there is no information about the type of oil it is very hard to find whether the oil price is reasonable or not.

Author mentioned PV system with batteries and have excluded the solution based only on rising price of the lead in recent past. I don't take it as a mistake, because the thesis specification doesn't mention energy accumulation at all. I believe that more detailed analysis of the use of LiFEPO₄ batteries not only for the PV system but moreover for increasing efficiency of diesel generators and maybe decreasing the installed power of the diesel generators could have changed the thesis from good to excellent.

Anyway, the quality of economic evaluation is good. The thesis would have been very good quality if inputs and assumptions have been better specified and further discussed. The Author should have given the thesis for review to someone who is able to understand the problem, but does not live with it on daily basis long enough before the dead line. Such reviewer could have raised a plenty of useful comments and/or questions.

I recommend grade this thesis

C – good

using the ECTS grading scale and I recommend work for defense.

I have several questions:

- 1) In the thesis there are mentioned many types of PV technology, their efficiencies etc. Could you please explain the difference between cell efficiency and panel efficiency? Could you please specify the technology of the panel (poly, mono, aSi...?) and calculate efficiency of the panels mentioned in the thesis? (CHN300-72P and HSE300-72M)
- 2) Could you please explain why is the 11D100 generator expensive in comparison with DG72M?
- 3) Could you please explain how have you come to conclusion that there has to be installed 2.6 MW in diesel generators?

Prague, June 15, 2016
Jan Gerstberger