

Review  
a master's thesis by Dmitry Muravyev on  
Stand-Alone Energy Supply System with Distributed Photovoltaic Generation

The thesis presented is devoted to an important problem of how distributed generation develops in different countries of the world, specifically in Russian regions. Due to modern technologies, the small energy generation as compared to the large one included in electricity supply networks is more competitive than a decade ago. The role of renewable energy source increases too, especially solar ones. At present a boom of the small distributed and renewable energy generation can be observed in most of the countries all over the world. As for Russia, it strongly lags behind the leading countries despite its high growth rates of commissioning of new facilities.

A non-traditional energy industry is highly dependent on the specific conditions observed in different countries, regions, and municipal units such as a demand for electric power and heat, availability of fuel, climate, and infrastructural and institutional conditions. An interesting and prospective way of studies in this field is an analysis and design of Stand-alone Power Systems (SAPS) on which the thesis by Dmitry Muravyev focuses. Such power facilities can obviously be very helpful for remote and under-populated areas, for example, those in Siberia (Russia) where many communities have no access to networks. The defender of thesis made a case-study for the diesel power plant and local network farms located in Totma – a remote settlement in the Irkutsk region. His final output is a feasibility study proving that an additional solar Photovoltaic block installed in this plant and creation of a hybrid plant would be efficient.

The methodology used and calculations made by the author are based on MS Excell, Homer Energy, and MatLab. To assess efficiencies of technologies and modes of their use regimes, he applied a capital assets pricing model (CAPM), calculations of the net present value (NPV), and internal rate of return (IRR). In general, it is possible to state that the methods used are of internal consistency and adequacy.

His tangible results are:

- a review of how the distributed energy generation developed in several countries of the world (Russia, the USA, Germany, the Czech Republic, and China) and what conditions contributed or impeded their development;
- analysis and application of the models describing the energy distributed Photovoltaic generation in the SIMULINK and MatLab systems;
- feasibility study of SAPS using distributed PV generation with assessment of technical and economic efficiency of the PV generation installed at a concrete community Totma in Irkutsk region (Eastern Siberia, Russia); he also carried out an analysis of whether the efficiency indicators are sensitive to changing price indicators.

The author concludes that creation of a hybrid distributed energy installation (the operating diesel station added with the PV block generation) in the Totma is effective in context of a wide range of predicted external conditions. This is a serious practical value of the thesis. The models constructed and methodology used are of a theoretical value too. They could be applied to other objects at changing parameters of climate, price indicators, institutional conditions as well.

The research considers all safety standards and regulations required by the authorities of the territorial subject of the Russian Federation chosen. The work is written clear with a good representation of graphic material and illustrations, and is successfully structured.

Grade: Excellent (A, 1).

Prof. Nikita Suslov  
Novosibirsk State University  
Department of Mathematical Methods and Models Applied to Economics