Potential for Using Renewable Energy Sources to Raise the Enterprise's Dependability of Responsible Energy Users

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Abstract: The essay discusses the enterprise's energy usage analysis, as the title suggests. The potential use of renewable energy sources to meet the enterprise's emergency needs is examined in this article. The essay examines the company's energy usage and suggests that an integrated energy system built on RES be developed. The utilisation of unconventional and renewable energy sources is suggested as a potential means of lowering global energy expenses. A lot of focus is placed on the metrological data, which is derived from the NASA portal via satellite data, and graphic representations are created. The article outlines the system's computations, displays graphs showing how it works, and discusses the potential for development.

Introduction:

Currently, issues related to energy usage are prevalent worldwide. Developing nations report a sharp rise in their energy use. Businesses report particularly significant shifts in energy use in relation to the expansion of equipment and production [1, 9]. According to the Schneider Energy University, one unit of conserved energy prevents the creation of three units, making company energy conservation issues the most important. The establishment of systematic measures for energy-saving strategy is the main objective of Russia's Energy Strategy. A stable energy supply system for customers is a prerequisite for the society's industrial, political, and economic growth to be sustained [2,13]. Modern Russian and international businesses pay close attention too.

METHODS:

The article discusses the possibility of implementing an integrated system at the "SVEL Power Transformers" company, located in Yekaterinburg, that is based on renewable energy sources (henceforth referred to as RES). An example of how to calculate a sophisticated power supply system based on RES (also known as CS RES) using the computer applications "VizProRES" and "HOMER Pro" is provided. The information gathered for the study can be utilised to get a complete image of the business. It is demonstrable while considering energy efficiency while accounting for renewable energy sources (RES) installations. The SVEL Group is a prominent producer of electrical equipment in Russia.

The business is situated in the Himmash microdistrict of Yekaterinburg. The terrain's coordinates are 54.75 degrees north and 60.73 degrees east. The office space, meeting rooms, server room, locker rooms, restrooms, and shower facilities are spread throughout four floors of the structure. The locations of the CCTV cameras, fire alarm and emergency lighting were found after looking up the building plan. The computation was done, and the kW value of the constant and variable load required to supply emergency consumers was determined. A total of 6.771 kW is drawn by the load.

The viability of employing and implementing renewable energy sources as a safety net for regular consumers in emergency operation modes was determined. The NASA portal for the city of Yekaterinburg's climate data was utilised to calculate the viability of CS RES construction. Figure 1 displays the information that was acquired regarding the RES potential. The graphic shows the average data for the specified location during a 22-year period [7,18].

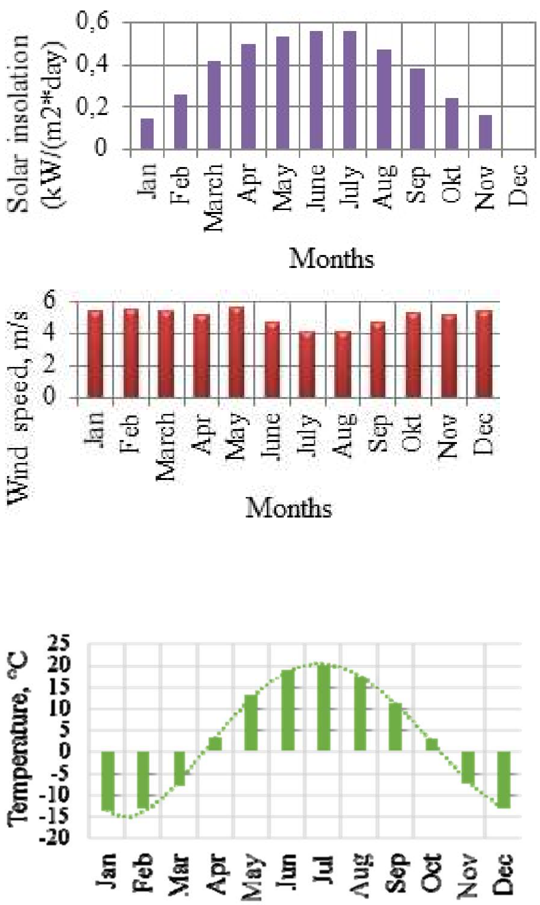


Fig. 1. Data of the incoming of solar insolation on a horizontal surface and wind speed in the city of Yekaterinburg.

• Using this application, you may determine the best equipment configuration based on RES while accounting for an autonomous consumer's complete supply within a specific geographic area.
• The program determines how much of each piece of equipment is needed by comparing the pros and cons of different possibilities.
• The program simulates the behaviour of the system over the course of a year, accounting for

daily or hourly swings in energy generation, while determining the ideal cluster.
• Permits you to view a graphical breakdown of the various system connecting possibilities.
•You can continue working without losing data by saving the calculated version for later download.

This program serves as an engine for the construction and analysis of complicated energy systems, such as wind turbines (WT) and photoelectric converters (PC) among others. The creation of graphs and the examination of the received systems are further features of the program. Rechargeable batteries, PCs, and WT are the primary pieces of equipment used in the CS of RES project. Equipment for the CS of RES calculation was chosen. Additionally, it was advised to take into consideration diesel generators (DG onwards) as a backup power source. Table 1 serves as an illustration of how the software functions and what the "VizProRES" program can do.

The software determines the ideal apparatus. Six PCs with the Exmork FSM-300M 300 W mark, three pairs of batteries with the Delta DTM 12250 L brand, and one WT 4/7 are included with the CS RES. Ancillary equipment is required to make sure the resulting system operates steadily. These pieces of equipment include an inverter and PC and WT controllers. Figure 3 displays the equipment operation diagram. Based on the examination of the collected data, conclusions regarding the cooperative operation of the PC and the WT were formed.

With the exception of one month each year, the combined efforts of PV and WT compensate for the climatic conditions' unevenness, allowing the battery to be charged nearly continuously at its maximum level. [4,10] The variation of the combined operation of the wind turbines and fotoelectric converters is more dependable, according to the computations.

TABLE I. THE CHOICE OF THE PC IN THE PROGRAM "VIZPRORES".

№	Model	Core Area, m^2	Efficiency %	Life time, years
1	TSM-200-24M	1.277	15.7	15
2	FSM--200-24П	1.306	14.9	15
3	. lar JAP6 60 3BB 255 Вт	1.626	15.5	30
4	Sunways ФСМ-270МВ 270 Вт	1.626	16.6	25
5	Exmork ФСМ-300М 300 Вт	1.94	18.3	30

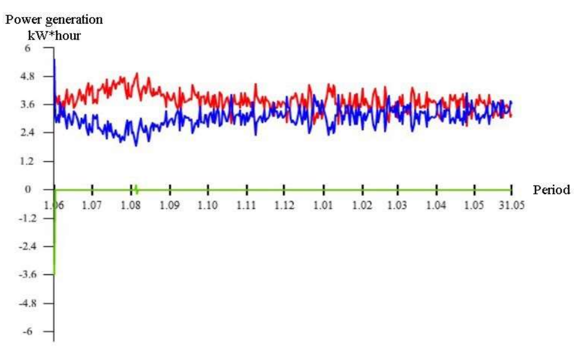


Fig. 2. The diagram of CS RES working during the year, calculated in the software "VizProRES".

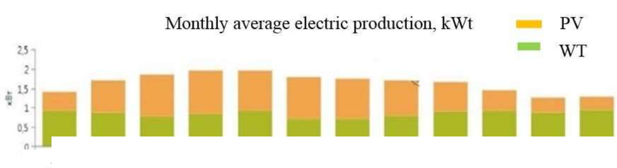
When the CS RES was being developed, the prospect of making a project in the "HOMER Pro" program was taken into consideration. This initiative is an international framework for maximising the development of integrated systems across all domains, ranging from remote sources and self-sufficient community services to network-connected universities and military

installations [8,14,15].
The software offers a wide range of equipment to design the best power supply system possible for the establishment. It is feasible to match the best choice for a specific CS RES from the list of different PVs and WT [12,18].
In the software, 25 possibilities for potential CS RES to the specified conditions were selected. Out of all of them, only one ideal CS RES version was selected.
Six PV, three battery pairs, and one WT are the best options under the circumstances (Figure 3).
Therefore, this iteration of the CS RES is the best one. Therefore, it is necessary to project the expenditures associated with building the CS RES.

RESULTS AND DISCUSSION:

The design of the electrical diagram of CS RES is shown in Figure 4. The calculation of the economic efficiency was carried out taking into account the capital costs for the purchase of equipment and construc-tion of CS RES, including transportation costs, procurement and storage costs, as well as installation costs and construction costs. [5,16,17]

The full list of equipment, its cost and total costs for the equipment are presented in Table 2.



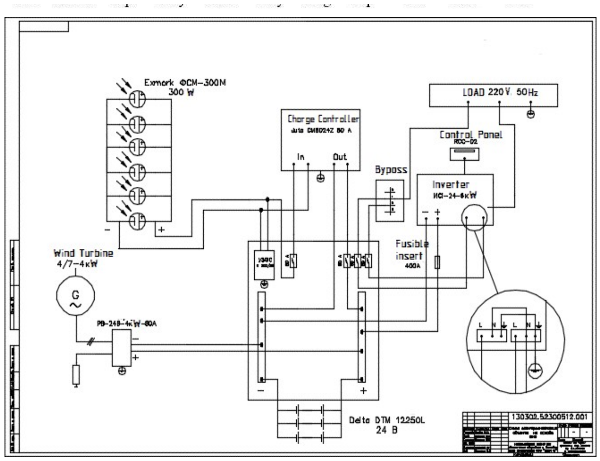


TABLE II. FULL LIST OF EQUIPMENT TO THE BUILDING CS RES.

Nomination	Amount	The unit cost	Cost (Rub)
Exmork FSM-300M 300 Wt	6	16500,00	99000
Wind turbine 4\7	1	103000,00	103000
Battery DELTA DTM 12250 L	6	27463,00	164778
Controller Juta CM8024Z 80A	1	13190	13190
Controller RV-24 B-4 кWt-80A	1	60000	60000
Inventor IS1-24- 6000Wt/24V	1	53400	53400
The wire PV3 25 mm	1000	122,5	122500
The wire PV3 35 mm	1000	175,1	175100
The wire PV3 95 mm	500	192,6	96300
Circuit breaker Schneider electric C120N	3	1750	5250
Armature	10	2000	20 000
Mast	1	23400	23 400
		Total (Rub)	940518

Total costs including delivery and installation is amounted to 1241883,76 rubles.

CONCLUSION:

The system's technical and economic indicators were calculated. Consequently, a 15-year payback time for CS RES was determined. 11.86 rubles per kWh is the cost of power from the receiving system. The effectiveness of the emergency power supply system was determined by the results analysis.

There are two reasons why using CS based on RES is required to ensure the enterprise's emergency needs: (1) a reduction in the probability of emergencies; and (2) an increase in power supply reliability. Many wealthy nations have successfully implemented CS RES in their organisations. For instance, since 2005, Sweden has benefited from a "Program for Energy Efficiency in Energy-Intensive Industries". This kind of curriculum is optional. The Swedish Energy Agency, in collaboration with the Swedish Tax Administration and the program's Board, which consists of representatives from multiple businesses, is in charge of the program. The Program's foundation is the voluntarily engaged participation of businesses with the resources to carry out the actions offered.

Companies that comply with the program take on the following responsibilities: 1) establishing mechanisms for regulating energy use; 2) performing a thorough review of your company's energy consumption; 3) The maximum payback period for investments made in energy efficiency related to energy consumption is three years.

A total of 126 enterprises applied to the program; these companies were mostly from the most energy-intensive industries: pulp and paper (47 companies), mining, steel, food, etc. Over 50% of the energy used by the nation's industrial sector is used by these enterprises [6,11, 19]. In Russia, it is imperative to develop CS using renewable energy sources. It's important to note that Yekaterinburg is home to over a thousand such businesses. Creating a CS RES of this kind for every business will help cut down on power bills considerably.

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