Preface

INTRODUCTION

The population of the Earth steadily grows. This circumstance puts forward all new problems and challenges. Such problem is steady providing population with foodstuff and other vital goods. For the decision of this problem constant involving in economic circulation of new lands and territories, suitable for the economic activities organization is required. Today there is such situation when in one territories the overpopulation while other territories are empty is observed and are not used for creation of the goods necessary for human life.

Such territories are available not only in the countries having the big territories, but also in the countries which had in small territories where along with the overpopulated zones there are deserted, sparsely populated territories.

Empty, deserted territories a case do not accustom to the majority because they are remote from the centralized sources of power supply, and independent power supply is complicated due to high cost of technologies and the equipment used for these purposes. At the same time last years the ideology of distributed, socially-oriented economy is spreading significantly. It gives the grounds to assume, that distributed placing of capacities, habitation, resources (including human) in the nearest future will essentially change our sights and approaches to development of territories, to existing financial, educational, technological and communication systems, their spiritually-moral reference points.

The solution of this global problem demands creation of technological and organizational preconditions. The modern level of a science and technics allows to offer new technologies and the equipment for a solution of a problem of power supply of such territories and perspective electro-technologies for transportation of the electric power and its effective utilization in manufacture of agricultural products and for maintenance of comfortable residing of people. However very often such information is not accessible to heads of local authorities, businessmen and the population, therefore is not used.

OBJECTIVE

This book will aim to provide relevant information for representation of the wide public advanced achievements in the field of electro-technologies, efficient use of electric resources and renewable energy sources which will be useful to a wide range of readers and doubtless positive impact on a solution of a problem of a sustainable development of new territories will make.

Generally the book covers all complex of the problems which decision provides both formation of the distributed economy and development of new territories as a basic element of this problem.

In the book the innovative technologies providing effective generation, transfer and use of the electric energy which use can provide successful development of new territories for realization of the concept of the distributed economy will be described.

The particular interest represents the fact that the considerable volume of the material presented in the book, was not published earlier in the English-speaking literature and consequently was not accessible to a wide range interested readers in the different countries of all continents.

Target Audience

The target audience of this book will be composed of professionals and researchers working in the field of energy efficiency, energy saving technologies, RES-based energy supplied systems, different kind's renewable technologies. Moreover, the book will provide insights and support executives concerned with the development of agricultural and industrial enterprises on new territories and sustainable development of this territories.

Recommended Topics

- Solar thermal energy installations
- PV solar
- Wind based energy generation installations and systems
- Small hydropower plants
- Specific i RES potential estimation methodologies in condition of meteor data absence
- Cogeneration PV Thermal modules fabrication and application
- RES application best practices
- RES potential in different countries and remote territories
- Diagnostic and monitoring methods for energy equipment status
- Providing parameters of solar power plant with given generation graph
- Innovative 10–110 kV compact controlled overhead lines
- Resonant Electric Power Systems for Renewables based Electric Grids;
- Resonant system of electricity transfer of high power
- Energy saving system for illumination of greenhouse plants
- Energy efficient electric equipment for heat supply in Agriculture
- Electric pulse cultivation
- Pre-sowing Seed Treatment in a Magnetic Field
- Use of Microwave Energy at Thermal Treatment of Grain Crops
- Scientific and methodological support of electric system operation
- Biological Objects Reactions Management
- Solutions for diesel, wind and solar power plants joint use for autonomous power supply

A description of the importance of each of the chapter is given as below:

Chapter 1: This chapter prescribes fundamental properties of GIS, their special features in usage of evaluating gross potential, regional energy consumers of different types and distributed energy grids development possibilities. Description of GIS elements for Republic of the Union of Myanmar is given: solar, wind, hydro, tide and wave energy resources, and their allocation, a real of source distribution, type and value of energy consumers.

Chapter 2: Solar heating supply in Russia has certain difference from the world experience in field of solar radiation (SR) data processing; solar collectors (SC) construction designs; solar heating supply systems (SHSS) calculation, testing and design guidelines; solar thermal systems (STS) construction and use practice. In this chapter examples of its use in the most southern region (Krasnodar region), and most of the northern region (Yakutia) are well presented. Methodical approaches to the development of SC designs from a comparison of energy consumption for their production and the amount of energy produced by them for life. The analysis of Russian and Europe STS design guidelines is made. This chapter also presented prospects of construction STS in Russia up to 2030.

Chapter 3: This chapter presents an analysis of the potential of solar energy in the Mary region of Turkmenistan. On the basis of the spent calculations of solar radiation in Mary, the estimation of quantity of falling solar energy is received, accepted by the solar panels. Optimal orientations of solar panels are defined. The analysis of the received settlement and measured data on electrical energy development by solar panels is carried out, and monitoring of work of photoelectrical solar station, wind power station and a solar collector is made as well.

Chapter 4: Solar energy is used for electricity production by means of photovoltaic modules and for heat supply by means of solar water-heating collectors. In recent years combined cogeneration photovoltaic thermal modules which work out at the same time both electricity and thermal energy began to be applied actively. This chapter includes consideration of the main types of co-generative photovoltaic thermal modules of different design such as planar liquid devices as well as devices with concentrator of solar radiation. The advantages and disadvantages of each type are presented. Main directions for improving the efficiency of converting solar energy into thermal and electricity are offered. Testing photovoltaic thermal modules with planar and concentrator design are presented in this chapter.

Chapter 5: The modern agricultural production, having territorially distributed structure, must be equipped with adequate measures and means of ensuring of electrical safety of work which can be divided into groups depending on nature of consumers of an electrical energy, a type of systems of power supply, type of electrical installations, cost, etc., and must answer the main requirement – the requirement of efficiency – to salvation of life of people and normalization of working conditions and stay in the action area of electrical installations. In this chapter actions for ensuring electrical safety of agricultural production four groups of innovative methods and technologies of creation of electrical safe working conditions have been well allocated.

Chapter 6: In this chapter an original approach to the measurements in agro-ecologic micrometeorology is suggested on the bases of renewable solar panels for energy supply to instruments at the remote sites and new turbulent model of the flow of the gases. Analytical dynamic model of the turbulent multicomponent flow in the three-layer boundary system is presented. The generalized advection-diffusion-reaction equation is derived for an arbitrary number of components in the flow. The models of mass and energy transfer will be an instrumental in simulation rural electrification concepts in general on the bases renewable sources.

Chapter 7: Electric current is the main electro-technological working tool in crop farming: it can initiate the plant growth and development, can suppress, damage and destroy them. The stimulating electro-technology example may be electric stimulation of ligneous plants grafting survival ability and growth; the suppressing and damaging current influence is vividly illustrated by the electro-impulse sunflower and tobacco plants pre-harvest processing; the demonstrative example of plants' electric destruction is the weeds control electro-impulse technology. The electro-technologies nature with key points' statements and the issue publications, their technological and economic efficiency are considered in this chapter.

Chapter 8: The methods and devices of energy saving regulation of operating modes of irrigative pumping stations based on principles of power loses reduction in pressure pipelines are scientifically substantiated and developed. The ways of protection of the main power equipment and pipelines of pumping stations from water hammer at transients are developed and devices for their implementation are designed in this chapter.

Chapter 9: With the artificial cultivation of plants require lamps with a certain spectrum of radiation. Industry produces special gas discharge lamp. LEDs can create light with any spectrum range from 360 to 800 nm. The authors of this chapter give a technique for modeling the spectrum of luminaires and calculating LED lamps for plants. The tests of the developed lamps for plants in dark chambers are provided in this chapter. A description of a resonant regulated power supply system for LED luminaires is given as well.

Chapter 10: This chapter is focused on solar cogeneration systems with silicon un-injunction photocells and an optimal combination of the values of solar radiation concentration ratio and solar cells cooling intensity within the laminar flow of coolant. The principles of designing solar radiation concentrators and photovoltaic panels are considered in this chapter. A fundamentally new technique for testing linear photovoltaic panels with a sun concentration is proposed, in which the absolute temperature of the radiating surface is logically introduced and a difficultly determined parameter is excluded, which takes into account the temperature distribution along the surface of the absorber from the location of the cooling coolant.

Chapter 11: Drying is the most power-consuming process of post-harvest processing. In this chapter, methods are viewed of how to heighten productivity of grain-drying equipment and to de-crease energy consumption of the process. Saturation of air with ions in this case is conducted cyclically. This allows using reactions of the biological object "caryopsis" on external impacts in order to heighten the efficiency of drying. Parameters of the drying agent are changed by controlling the electric heater. Dependency of the rate and energy consumption of drying on parameters of the drying agent allows controlling the process by control-ling the electric heater. The chapter presents experimentally obtained dependencies, which allow for designing algorithms of control of the aforementioned type.

Chapter 12: This chapter presents express method for estimating the solar energy potential at a given point on the basis of combination of the solar radiation daily profile application method under absolutely clear sky and actinometrical data of the NASA electronic base. For the speed and convenience of calculations based on the proposed methodology, it was implemented in the form of computer program. This chapter also analyzes the influence of spatial orientation on the maximum electricity production during the month, season and year and it reveals that the use of optimal inclination angles for the specified periods of time makes it possible to realize the existing solar potential of the region more at the same capital expenditures.

Chapter 13: Implementation of compact overhead lines equipped with FACTS devices, including phase angle regulator settings (compact controlled OHL), appears to be one of the most effective ways of power grid development. Results of comprehensive research and development in relation to 10–110 kV compact controlled power transmission lines together with theoretical basis, substantiation, and methodological approaches to their practical application, design experience are given in this chapter.

Chapter 14: In this chapter I-V characteristic of illuminated PV cell varies with temperature changes are well investigated. The effect is explained according to the solid states theory. The higher temperature, the lower open-circuit voltage and the higher short-circuit current. This behavior is explained on the basis of band theory of the solid state physics. The increasing temperature causes a narrowing of the forbidden gap and a shift of the Fermi energy level toward the center of the forbidden gap. These both effects lead to a reduction of the potential barrier in the band diagram of the illuminated PN junction, thus to decrease of the photovoltaic voltage.

Chapter 15: Fundamental characteristics of distributed power systems and usage patterns of renewables in such systems are considered in this chapter. The chapter presents full description of hybrid power complex consisted of renewable power sources, converters, energy storages, heat, electricity transmission, distribution devices, controlled electrical, heat consumers and etc. Special features of wind, solar and hydro power plants operational states at self-balanced hybrid power complexes are given in this chapter. Description of controlled consumer's characteristics is presented as well as capability of consideration of hybrid complex being Micro-Grid under their influence. The chapter also prescribes examples of technical and economical features of hybrid power complexes of different structure, their future design and development.

Chapter 16: This chapter describes the features of the work of wind receiving devices in the insufficient power mode when the current wind speed is below the construction value of the wind power plant. The term "effective angle" is introduced. The importance of this problem is shown and the amount of time in the insufficient power mode for example wind power plant is calculated. The main characteristics of an electrical generator and a wind receiving device are considered. The importance of the mapping the characteristics of the wind receiving device and the electrical generator is shown.

Chapter 17: This chapter proposes the interpretation of the concept of "power supply system efficiency" and a mathematical model which focuses on minimization of electricity supply expenses while observing the time criteria. The research examines the constituents of the specified time criteria, the calculations of power outage time and the time of power supply restoration. In addition, this chapter describes the constituents of implementation time for a technological connection of rural consumers to electric networks and the statistical data on the time of inconsistency between power quality and regulatory requirements.

Chapter 18: Maintenance of power equipment system is based on the industry standard of averaged volumes of standard maintenance and repair of power equipment, frequency and duration of the preventive measures, the nomenclature and consumption of materials and spare parts to perform operations. One of the more efficient uses of electrical equipment is to improve its maintenance system through the development and implementation of service strategies for the actual condition. This chapter proved the necessary conditions for the realization of electric service strategy on defining the main diagnostic parameter. The results of studies of the new techniques development for improving the operation of electrical systems are well presented.

Chapter 19: The results of comparison of parameters of a classical electric power supply system with an electric power supply system using single-wire wave-guide lines with high frequency, proposed by N. Tesla 100 years ago, are presented in this chapter. The future world energy model based on direct solar energy conversion and transcontinental terawatt power transmission with the use of resonant wave-guide technology developed by N. Tesla is proposed. The trends of the future development of electric engineering and energy technologies for agriculture, space exploration, solar energy, hydrogen energy and electric transport based on resonant wave-guide methods of electric power transmission and application are suggested.

Chapter 20: In this chapter the thermal treatment is used for different grain crops during the processes of drying, disinfection and preparation to feeding, etc. The high cost of the processes is caused by the cost of energy and the energy-output ratio of the processes. The development of the processing regimes with the use of electric technologies in general and electromagnetic fields in particular can reduce the cost of the mentioned processes. The use of the special programs gives vast possibilities for the design of such equipment.

Chapter 21: One non-traditional types of renewable energy vortex is energy, which is a technology of using swirling flows of continuous media (e.g., liquid and gas) - for converting them into heat energy, work, temperature and pressure gradient are investigated in this chapter. Interest in the study of vortex formations supported worldwide in over a long period of time - vortex structures are systematically identified in many of the physical processes. In recent years, the study of vortex motions facts were discovered, which served as an incentive to new aspects of the study of the vortex.

Chapter 22: For the transmission of electric energy from renewable energy sources requires a system of transmission of electrical energy. The most widespread system of electric power transmission is AC and DC. This chapter presents the description of a resonant system of electric power transmission on one wire. This system converts AC or DC voltage and transmits it over a single wire. At the end of a transmission line is a reverse Converter that generates the standard voltage. This system of transmission of electrical energy can be applied to lighting systems.

Chapter 23: In this chapter Shale Gas has been considered as an unconventional resource to date due to economics and technical challenges encountered. Under current circumstances, shale gas has and is receiving increasing attention as it is being quickly known as a viable energy resource. Countries who have been out of the energy game so far have an opportunity to be key players in the same industry. Current enhancement in technology and improved methods for fracking has proven that recovering shale gas is a viable and economical sound option in this century.

Chapter 24: The reclamation of new areas or distant lands, which have limited energy and material resources, requires the use of energy saving technologies, which include presowing processing of seeds in magnetic field are investigated in this chapter. The aim of this research is to reveal the effect which magnetic field has on seeds, to detect the most effective condition to process seeds in magnetic field before sowing and constructive parameters of the equipment.

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